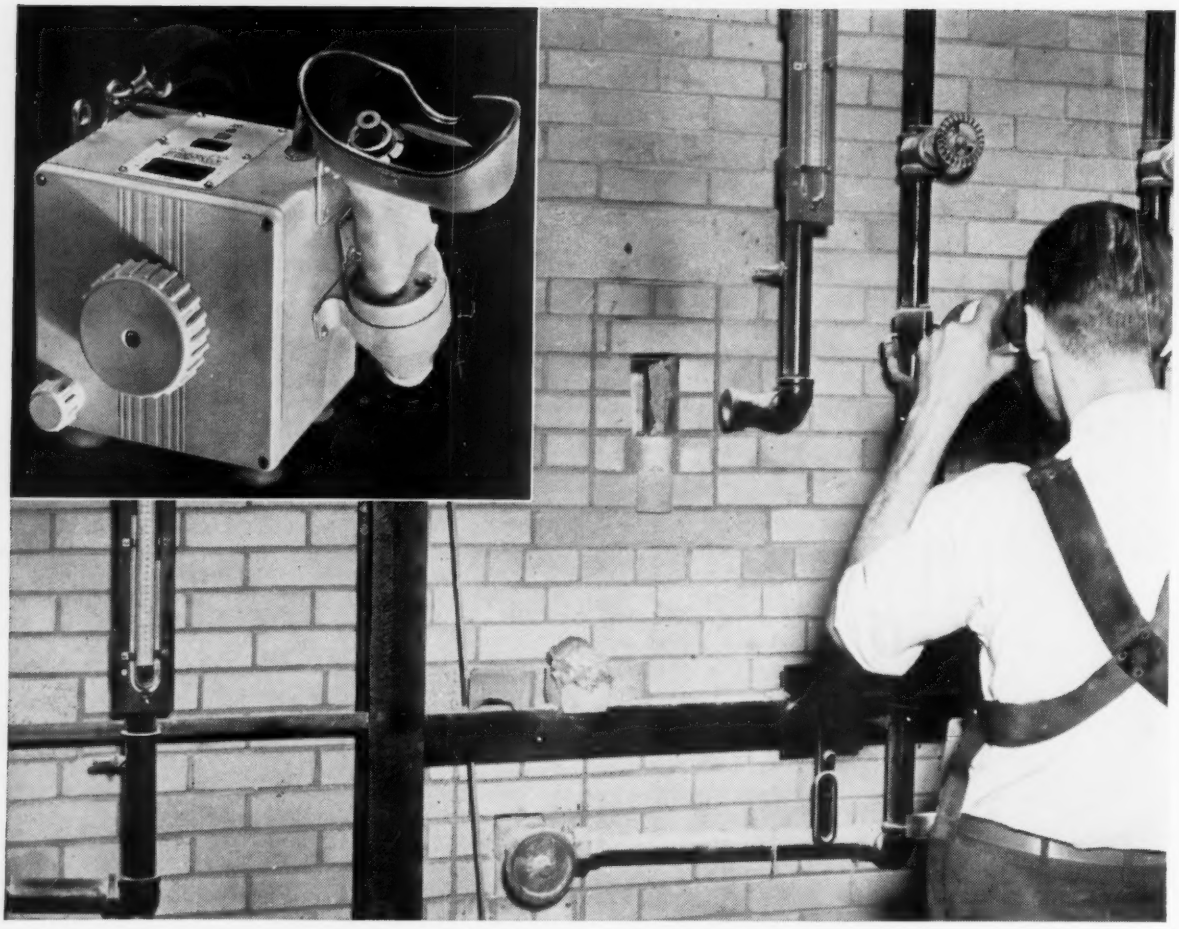
CERAMIC ABSTRACTS and THE BULLETIN

OF THE

AMERICAN CERAMIC SOCIETY

APRIL 15, 1944

MONTHLY PUBLICATION DEVOTED TO THE ARTS AND SCIENCES RELATED TO THE SILICATE INDUSTRIES



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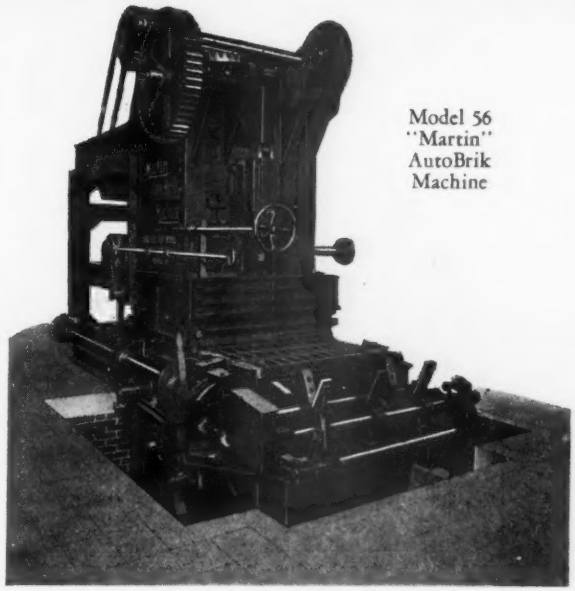

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OPERATIONS described above are performed by *one* combined unit—the "Lancaster" AutoBrik Machine and Automatic Pallet Car Loader. This is the only combination of automatic brick making and loading machinery available today.

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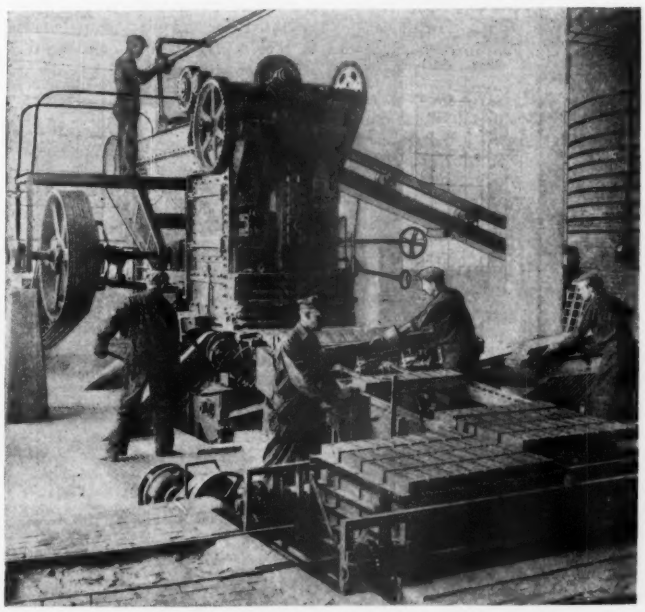

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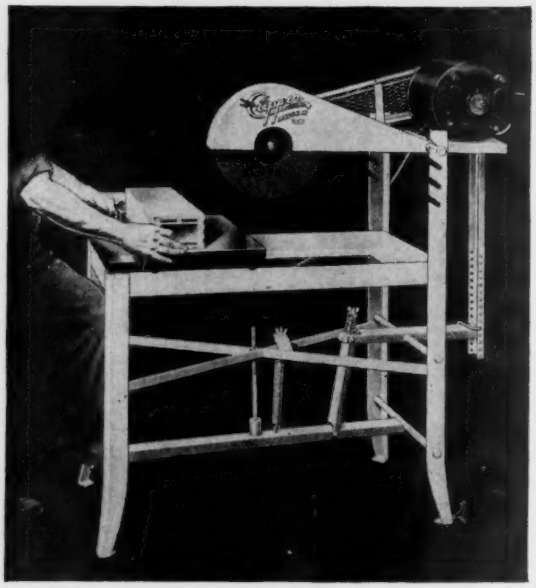

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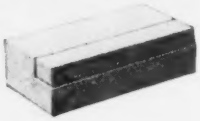
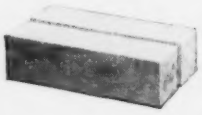
This acid brick intended for a chemical plant acid chamber was cut completely in two, in just 37 seconds.

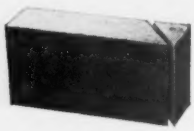
One of many intricate cuts performed on first quality clay brick for heat treating furnaces. Made in 8 sec.





Silica brick cut lengthwise for open hearth furnace work, only 9 seconds were required to complete this cut!

Basic refractories for steel furnaces or cement kilns must be accurately installed. This magnesite brick was cut in 12 seconds.



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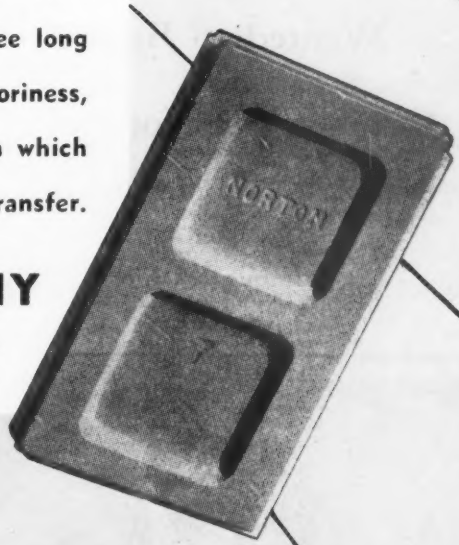

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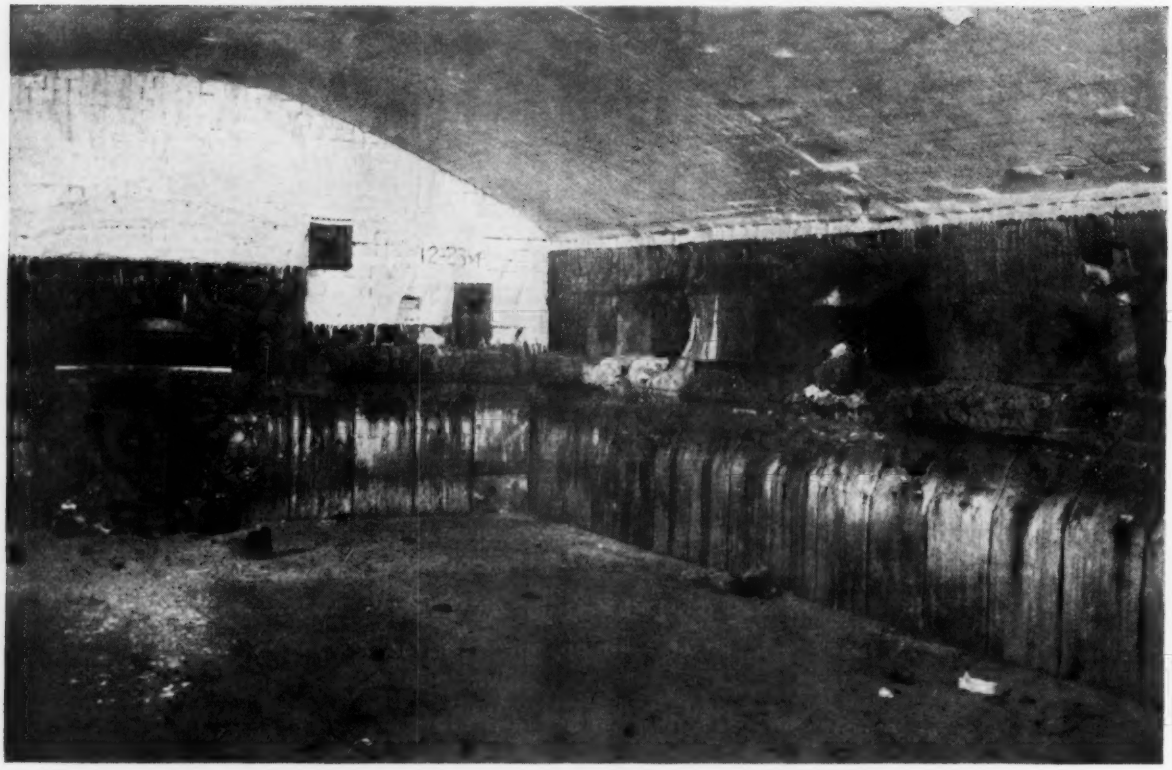

ANOTHER INTERESTING CORHART REPORT

LAST month we published four pictures of a Corhart* Electrocast tank which had run 1199 days and produced 104,890 tons of flint and amber glass (153.3 tons produced per square foot per life).

We thought you might want to study the detailed figures. So here they are:

TOTAL DAYS LIFE	1199
TOTAL IDLE DAYS	48
TOTAL OPERATING DAYS	1151
TOTAL TONS GLASS PRODUCED (FLINT AND AMBER)	104,890.78
AVERAGE DAILY TONNAGE LIFE	87.48
AVERAGE DAILY TONNAGE OPERATING DAYS	91.13
SQ. FT. PER TON LIFE	7.82
SQ. FT. PER TON OPERATING DAYS	7.50
TONS PRODUCED PER SQ. FT. PER LIFE	153.35

This furnace was built of Corhart Electrocast throughout the melting and refining-end sidewalls, throat, doghouse and breastwalls, plus outer course bottom blocks in the melting and refining ends, and a section of bottom in front of the doghouse. All blocks were Corhart Standard except the throat, several superstructure shapes and two melting-end sidewall blocks beneath the No. 1 port, which were Corhart Zed. (Note the two Zed sidewall blocks shown in the photograph). The furnace operated approximately four months on flint bottle glass, after which it was changed over to amber.

The furnace *did not fail.* No patch blocks or waterjackets were used at any time on Corhart materials. At the conclusion of the campaign it was found that the furnace could have been operated for several additional months.

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Ceramic Abstracts Section

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THE AMERICAN CERAMIC SOCIETY

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PERIODICAL REFERENCE: The name of the periodical appears in italics, followed by the volume (bold-faced), issue number (in brackets), page numbers, and year (in parentheses).

Vol. 23 April 15, 1944 No. 4

Abrasives

Attachments that increase versatility of high-production grinding machines. H. E. BALSIGER. *Machinery* [N. Y.], **50** [6] 147–52 (1944).—Many grinding problems in present-day war production can be solved by (1) installing a standard high-production plain cylindrical grinder and giving it the necessary versatility by means of attachments and extra equipment or (2) obtaining a universal machine and increasing its "in-built" versatility in the same way. Several new attachments for particular grinding tasks are described. R.H.B.

Attempt to belittle the diamond as a cutting tool. ANON. *Ind. Diamond Rev.*, **1** [4] 24–25 (1941).—In the "Manual on Cutting Metals," prepared by the A.S.M.E. Committee on Metal Cutting Data, published in 1939 by the American Society of Mechanical Engineers, New York, only nine lines are devoted to diamond tools; it is said that diamond tools "are used to a limited extent." This article proves that the "limited extent" refers to hundreds of diamond tools used in the largest concerns. Cemented carbides are also used to an increasing extent for roughing operations before diamond turning and boring. P.G.

Calder grinding-wheel dressers. ANON. *Machinery* [N. Y.], **50** [6] 205 (1944).—A new line of diamond grinding-wheel dressers has been announced by the Calder Mfg. Co., Lancaster, Pa. R.H.B.

Centralized grinding for single-point tools. WALTER E. AINSWORTH. *Iron Age*, **152** [13] 51–53 (1943).—Optimum conditions are attained by ascertaining correct angles and contours of tools and maintaining uniformity by machine grinding with the individual human factor eliminated as much as possible. At one plant, all of the carbide single-point tools and two-fifths of the high-speed tools are reconditioned in a central grinding room with trained operators using standard and special tools. E.H.McC.

Coated abrasive gadgets speed finishing operations. ANON. *Iron Age*, **151** [8] 48–51 (1943).—For polishing, burring, and grinding on work of small dimensions, the Behr-Manning Corp. has developed several devices coated with abrasive Metalite cloth. These are very flexible in operation, and some are adjustable in dimensions. E.H.McC.

Cutting resistance of shaped diamond tools. ANON. *Ind. Diamond Rev.*, **2** [21] 43–44 (1942).—The cutting forces of shaped diamond tools are very small, usually calculated between 3 and 4 lb. No suitable instrument for measuring these forces has hitherto been available, but a new instrument has been developed which consists of a special tool holder and an instrument box containing the necessary electrical instruments, including an automatic voltage control. The principle of the measuring circuit is the comparison of the apparent resistance (impedance) of the variable choking coil with a comparison coil in the instrument box. Diagrams of the cutting force in relation to cutting speed for aluminum bronze and brass are given. P.G.

Diamond versus cemented carbide. ANON. *Ind. Diamond Rev.*, **1** [3] 21 (1941).—The diamond as a cutting tool has profited from the advent of cemented-carbide tools. Cemented carbide was invented to replace the diamond in precision work as a die, as a cutting tool, and for similar uses. Work was based on the assumption that cemented tungsten carbide is nearly as hard as the diamond, but it was soon found that carbide is far too brittle for wire-drawing purposes and must be blended with a suitable binder material. Cemented carbide was first considered to be a competitor of the diamond, but at present large amounts of diamond dust are utilized for lapping cemented carbide tool edges, and the diamond is recognized as a first-class tool. P.G.

Early use of polished diamond tools. ANON. *Ind. Diamond Rev.*, **3** [29] 19–20 (1943).—Shaped diamond tools were used more than a century ago. Between the years 1822 and 1830 in a small magazine published in London, *Gill's Technical Repository*, an engraver named Turrel made a special study of diamond cutting and of jewels as tools. Descriptions and illustrations of tools used at that time are given. Bibliography. P.G.

Grinding milling cutters with resinoid-bonded wheels. J. E. ROGERS. *Iron Age*, **152** [17] 34–39 (1943).—Because of their coolness, free cutting, and ability to retain form, resinoid wheels have reduced time in grinding and increased production 10%. In grinding milling cutters, these wheels have superseded vitrified wheels and have produced a better surface. No. 2 aluminum oxide grain is best suited for combining with a resinite bond. E.H.McC.

Grinding steel-cutting carbide tools. W. L. KENNICOTT. *Machinery* [N. Y.], **50** [6] 158–61 (1944).—Correct methods of grinding carbide tools for cutting steel will

greatly prolong the life of the tools and increase cutting efficiency, thereby reducing costs. K. describes (1) the procedure for rough-grinding tools, (2) the finish-grinding operation, (3) grinding in rigid fixtures, (4) incorrect grinding, (5) effect of incorrect grinding on the strength of tools, and (6) the avoidance of cracks and checks. R.H.B.

Grinding thin-walled cylinders. ANON. *Iron Age*, **151** [11] 51 (1943).—Cylinder barrels of Pratt & Whitney air-cooled aircraft engines suffer distortion by heat during external grinding. A new type of arbor supports the wall and permits internal and external cooling. E.H.McC.

Hardness differences in diamonds: I. P. GRODZINSKI. *Ind. Diamond Rev.*, **3** [27] 7–11 (1943).—The hardness differences between diamonds from various localities and the hardness differences in the crystal surface or layers of a single diamond are not taken into account when the hardness of the diamond in relation to other materials is discussed. The term "hardness" is assumed to be equivalent to wear resistance. Brazilian diamonds are supposed to be the hardest, although they are sometimes surpassed by South African diamonds of high quality. Generally, alluvial diamonds are harder than those from mines. Twins (macles) are exceptionally hard, due to the interlocking crystal structure. The trade holds the general opinion that the skin of the stone is harder. Every aspect of the subject is fully discussed. **II.** *Ibid.*, [28] 13–16.—The hardness differences in diamonds are discussed according to the theory of Kraus and Slawson, formerly advanced by Continental scientists. The faces of the cube are easiest to cut and polish; no progress in cutting and polishing can be made if the facet is exactly parallel to the octahedron plane; the rhombic dodecahedron faces cut and polish intermediary between cube and octahedron. V. Stott, in his interpretation of the actual test results obtained by Marcel Tolkowsky, states that the dodecahedral plane is the softest, followed by cube and octahedron. The differences must still be clarified. The scientific hardness theory is based on the interatomic spacing in the diamond crystal which has been found by X-ray analyses, but this theory has not yet been used to determine whether all diamonds have the same spatial distance between atoms and, if so, whether any difference is found between so-called "soft" and "hard" diamonds. Against this theory there is the theory of the hardness of the skin, the general use of points which should be softest and testimonials of experienced diamond cutters that the point is the hardest part of the stone, and the possibility of an error in designing the space pattern. P.G.

Hill-Bartelt radius grinding fixture. ANON. *Machinery* [N. Y.], **50** [6] 210 (1944).—The Hill-Bartelt Machine Co., Rockford, Ill., has developed a new radius grinding fixture for use on standard tool-grinding machines for profile grinding 180° radius (or smaller) arc forms on the teeth of milling cutters 3 to 6 in. in diameter and up to 1 in. in thickness. R.H.B.

Landis improved plain hydraulic grinders. ANON. *Machinery* [N. Y.], **50** [6] 192 (1944).—Important refinements have been incorporated in the 10- and 14-in. plain hydraulic grinders built by the Landis Tool Co., Waynesboro, Pa. R.H.B.

Microphotography of the facets of industrial diamonds. F. KAYSER. *Ind. Diamond Rev.*, **4** [38] 2–3 (1944).—In general, polished diamond facets have such a high degree of perfection that nothing can be learned by microscopic examination, but natural facets that are found on some diamonds show clear surface markings. Various methods of approach for taking the photomicrograph are discussed, including interference bands through an inclined coverslip observed under monochromatic sodium light. Illustrated. P.G.

New carbide-tipped tool. ANON. *Mech. World & Eng. Record*, **113** [2934] 323–24 (1943).—A new Firth-Brown grade of sintered carbides is discussed which can be used on ordinary machine tools with all the advantages of the hard-metal tool. The speeds and feeds recommended vary considerably, as an outstanding feature of the grade is the ability to operate over a wide range of conditions. P.G.

Oster chaser-grinding fixture. ANON. *Machinery* [N. Y.], **50** [6] 196 (1944).—A new universal chaser-grinding fixture has been introduced by the Oster Mfg. Co., Cleveland 3, Ohio. R.H.B.

Polished diamond tools of a century ago said to cut hard steel. ANON. *Ind. Diamond Rev.*, **3** [30] 29–30 (1943).—Excerpts from old literature show that diamond tools were used for industrial purposes more than a century ago, including the turning of hard steel. The working instructions are given. Bibliography. P.G.

Polishing with glue-abrasive mixtures. J. F. SIEFEN. *Iron Age*, **151** [11] 56–57 (1943).—The smoothing of metal surfaces is expedited by the use of glues unaffected by temperatures produced in burring and polishing. The following cycle of operations is typical: (1) Grind for the shaping of surfaces and the removal of deep marks. No. 46 rubber-bonded wheels are used. (2) Rough polish, generally with No. 90 aluminum oxide grit. A wheel set up with cold glue produces 2 to 5 times as much work as that obtained with hide glue. (3) Oil out with No. 150 or No. 180 aluminum oxide grit. A blend of grit and cold glue is brushed on the wheel. (4) Brush with an oil-treated Tampico wheel using a fast-cutting burring compound, not emery cake. E.H.McC.

Production surface grinding to micro-inch finish. H. J. CHAMBERLAND. *Iron Age*, **152** [20] 54–56 (1943).—To avoid vibration, a major essential of grinding machinery is weight. Proper maintenance of magnetic chucks is imperative. The coolant for precision surface grinding should be made of an oil which emulsifies readily, has good wetting action, and is reasonably free from foaming. E.H.McC.

Securing fine surfaces by grinding: IX. H. J. WILLS AND H. J. INGRAM. *Machinery* [N. Y.], **50** [6] 167–70 (1944).—Coolants are discussed. Fine grinding requires a copious supply of correctly selected coolant, directed at the point of contact between the work and the grinding wheel. Preferably, the work should be kept at room temperature. The coolant serves to protect the work from surface scratches and similar blemishes by washing away atmospheric dust, chips of metal, and particles of abrasive and bond material which have been torn from the grinding wheel. The primary purpose of a coolant is to keep the work cool; it should absorb heat readily, i.e., it should have a high specific heat. The coolant should contain a rust inhibitor to protect the work and the machine. Transparent coolants should be used in preference to opaque ones. The bond of vitrified wheels is unaffected by any kind of coolant, but rubber bonds deteriorate under the action of some of the oils used in coolants. Alkaline coolants cause deterioration in resinoid, shellac, and silicate bonds. A coolant should be chemically stable, so that it will not become rancid or decompose. It is strongly recommended that all coolant systems be equipped with filters as well as settling tanks. It is poor economy to try to reduce the amount of coolant used. A copious flow should be provided at all times. Soluble oil coolants and soap-solution coolants and mineral oils are described. R.H.B.

Testing hardness and uniformity of abrasive wheels. P. GRODZINSKI. *Ind. Diamond Rev.*, **3** [36] 61–63 (1943).—In the Laboratories of Gillette Industries a comparator has been developed for the routine testing of fine grained aluminum oxide wheels used for the fine grinding of razor blades. The machine consists of a stable base on which the abrasive wheel rests. The hardness is tested by a spindle, which carries on its end a four-sided diamond pyramid of 90° including angle, and is loaded with a weight of $3^1/_2$ lb. The penetration of the diamond as a result of 15 revolutions is taken as a measurement of the hardness of the wheel. Results obtained with differently shaped points, partly diamond and partly steel, are discussed. Diagrams show the behavior of grinding wheels under varying test conditions. P.G.

Use of diamond laps. A. E. ALEXANDER. *Ind. Diamond Rev.*, **2** [18] 27 (1942).—Diamond laps are used for the preparation of rock and mineral sections, as well as in the industrial microscope. A certain type of diamond lap can be used for the preparation of thin sections. The laps are made of Bakelite and are 19 mm. thick and 101 mm. in diameter. The diamond particles, carefully graded, are embedded in one surface to a depth of 1 mm. The diamond particles are of No. 240- and No. 400-mesh. Illustrations of sectioned cultured pearls are given.

P.G.

PATENTS

Abrasive article. GARRET VAN NIMWEGEN (Carborundum Co.). U. S. 2,342,313, Feb. 22, 1944 (Sept. 6, 1941).—A bonded abrasive article comprising a bonded abrasive body, a rigid metal supporting means, and an intermediate cementing layer between the bonded abrasive body and the rigid metal supporting means adhesively uniting the two, the cementing layer comprising polychloroprene compounded with a substantial amount of a filler such as carbon black.

Abrasive article. S. S. KISTLER (Norton Co.). Can. 417,716 and 417,717, Jan. 11, 1944 (Dec. 7, 1942; in U. S. Feb. 4, 1942). G.M.H.

Abrasive article and method of making. R. H. LOMBARD (Norton Co.). U. S. 2,343,218, Feb. 29, 1944 (Jan. 22, 1942).—The method of making a vitrified bonded abrasive article comprising the steps of making a mix of abrasive grains and a bond mixture of bond ingredients that include at least two powdered borosilicate glasses that constitute a substantial portion by weight of the bond mixture, one of the borosilicate glasses being a low fusing low-silica glass having a silica content, calculated as SiO_2, of between about 45 and 68% by weight and the other being a high fusing high-silica glass having a silica content, calculated as SiO_2, of between 70 and 96% by weight, the mix containing a quantity of the low-silica glass to provide, during subsequent firing of the mix, a fluid glassy matrix of low viscosity to wet the grains and containing the high-silica glass in a quantity to increase the viscosity, during the firing, of the bond mixture to thereby prevent deleterious shrinking and slumping, shaping the mix to the desired configuration, and firing the shaped mix to effect fusing of the low-silica glass ingredient to a fluidity to wet the abrasive grains of the mix and to effect partial fluidity of the high-silica glass ingredient, whereby the resultant low fluidity of the high-silica glass increases the viscosity of the bond mixture and thereby prevents deleterious shrinking and slumping during maturing.

Abrasive wheel. A. ABBEY (Carborundum Co.). Brit. 558,900, Feb. 9, 1944 (July 22, 1942).

Abrasive wheel and process of making. A. C. CIELL. U. S. 2,342,121, Feb. 22, 1944 (April 3, 1941).—A grinding wheel which comprises the fired product of a substantially unpressed dry mixture comprising 53 to 80 abrasive material, 1 to 20 clay, 1 to 16 whiting, 1 to 25 gypsum, and 0.5 to 10% combustible carbonaceous material, the wheel having a spongelike structure, the pores of which are of varying size, irregular shape, and heterogeneous distribution and in such free intercommunication as to allow free travel of a fluid therethrough toward the point of grinding when the grinding wheel is in use, thereby continuously cooling the ground face of the material being ground and substantially preventing loading of the grinding face of the wheel with particles of the material.

Apparatus for measuring or indicating roughness or undulations of a surface. KAPELLA, LTD., AND R. E. REASON. Brit. 558,355, Jan. 12, 1944 (May 18, 1942).

Art of grinding. G. D. SCHOGER. U. S. 2,341,820, Feb. 15, 1944 (July 20, 1943).—Means for dressing grinding wheels.

Bonded abrasive article. S. S. KISTLER (Norton Co.). Can. 417 863, Jan. 18, 1944 (Dec. 8, 1942; in U. S. April 15, 1942) G.M.H.

Cup-shaped abrasive wheel. E. VAN DER PYL (Norton Co.). Can. 417,715, Jan. 11, 1944 (Nov. 19, 1942; in U. S. Dec. 1, 1941). G.M.H.

Device for supporting a diamond or other hard substance during grinding. W. ASQUITH, LTD., T. P. N. BURNESS, AND A. JOHNSON. Brit. 558,753, Feb. 2, 1944 (July 16, 1942).

Diamond abrasive wheel manufacture. GEORGE CROMPTON, JR. (Norton Co.). Can. 418,171, Feb. 1, 1944 (Nov. 2, 1942; in U. S. Nov. 14, 1941). G.M.H.

Forming and dressing grinding wheels. COVENTRY GAUGE & TOOL CO., LTD., H. H. HARLEY, AND J. E. WAINWRIGHT. Brit. 558,237, Jan. 12, 1944 (Aug. 6, 1942).

Grinder machine reeling system. LOUIS ILLMER AND V. R. PALLAS (Pallas assignor to L. T. Pallas). U. S 2,343,460, March 7, 1944 (Feb. 26, 1942).

Grinding of cutting tools. A. C. BEDFORD. Brit. 558,974, Feb. 9, 1944 (Aug. 1, 1942).

Grinding fixture. JOSEPH BOCHENEK. U. S. 2,343,-637, March 7, 1944 (Nov. 2, 1942).

Grinding machine. W. M. POLSON. U. S. 2,342,889, Feb. 29, 1944 (Sept. 19, 1942).—A device for forming radial clearance on a tool of the fluted type adapted to be used with a grinding means.

Grinding machine. J. E. POORMAN. U. S. 2,343,577, March 7, 1944 (Aug. 10, 1942).—In a machine including a reciprocating member, a power train for operating the member having its inauguration in a continuously driven unidirectional power means, the power train including a gear section directly operating the member, means for interrupting the effective influence of the power train on the member at any selected point in the travel of the member in either direction, the interruption completely stopping member movement without interfering with continued power-train operation other than such gear section, means for reversing movement of the power train, and means actuated by the continued operation of the power train following complete stopping of member movement to operate the reversing means.

Grinding machine shoulder-grinding apparatus. J. I. GARSIDE (Norton Co.). U. S. 2,342,854, Feb. 29, 1944 (May 13, 1942).

Grinding wheel. R. H. LOMBARD AND L. H. MILLIGAN (Norton Co.). Can. 417,714, Jan. 11, 1944 (Nov. 10, 1942; in U. S. Dec. 6, 1941). G.M.H.

Grinding wheel form dresser. W. F. DALZEN. U. S. 2,341,022, Feb. 8, 1944 (Dec. 18, 1941); divided out of U. S. 2,277,213, March 24, 1942 (April 19, 1941).

Hack saw grinding fixture. N. C. SMITH. Brit. 558,293, Jan. 12, 1944 (June 25, 1942).

Honing apparatus. W. M. FAIRBAIRN AND S. M. BURDICK (Barnes Drill Co.). U. S. 2,343,500, March 7, 1944 (Jan. 21, 1942).

Honing machine. H. J. CALDWELL AND E. Y. SEBORG (Barnes Drill Co.). U. S. 2,343,275, March 7, 1944 (Aug. 1, 1941).

Honing tool for tubes. J. E. KLINE (Micromatic Hone Corp.). U. S. 2,343,013, Feb. 29, 1944 (Dec. 13, 1940).

Method of and apparatus for making abrasive wheels and drills. NORTON GRINDING WHEEL CO., LTD. Brit. 558,721, Feb. 2, 1944 (Dec. 18, 1941).

Method and machine for grinding tapered rollers. A. R. SPICACCI (General Motors Corp.). U. S. 2,341,825, Feb. 15, 1944 (June 6, 1941).

Polishing machine. G. E. HULBERT AND H. S. INDGE (Norton Co.). U. S. 2,341,442, Feb. 8, 1944 (March 25, 1941).

Power operated machine tool. R. R. ROEMER. U. S. 2,343,243, March 7, 1944 (July 31, 1940).—A laterally extending arm on the frame supporting a horizontal trackway, a tool reciprocable on the trackway, and means to support the trackway on the arm to rotatably swing in a horizontal plane to adjust its position and to lock it in any adjusted position.

Precision grinding machine. E. C. SHUGARS. U. S. 2,343,811, March 7, 1944 (Nov. 5, 1943).

Tools for dressing the operative surfaces of grinding wheels, etc. E. L. MEESON AND J. I. MEESON. Brit 558,295, Jan. 12, 1944 (June 26, 1942).

Art and Archeology

BOOK

Munsell Book of Color. Munsell Color Co., Baltimore, 1942. Loose leaf, boxed. 12 pp., 22 color charts. Price $25.00. Reviewed in *Bull. Amer. Assn. Petroleum Geologists*, **28** [1] 128–37 (1944). G.M.H.

PATENTS

Cookie jar design. K. M. GALE (Ohio China Co., a partnership composed of R. F. Knutti and E. J. Ronal). U. S. 137,273, Feb. 15, 1944 (April 5, 1943).

Design for molded glass candy container. T. H. STOUGH. U. S. 137,299, Feb. 15, 1944 (Oct. 15, 1943).

Goblet design. C. J. UHRMANN (Imperial Glass Corp.). U. S. 137,211, Feb. 8, 1944 (Oct. 15, 1943).

Cements

* **Action of sodium chloride solutions on tricalcium aluminate.** D. DSCHORBENADSE, R. MOSEBACH, AND R. NACKEN. *Zement*, **31** [49/50] 513–18; [51/52] 527–33 (1942).—The effect of NaCl solutions of various concentrations was tested on tricalcium aluminate. The original $CaO:Al_2O_3$ ratio was 3:1; by adding CaO, the ratios of 4:1 and 5:1 were obtained. In all instances the double salt $3CaO \cdot Al_2O_3 \cdot CaCl_2 \cdot 10H_2O$ was formed. No true equilibrium in the product was established. Besides the above double salt, various Ca aluminate hydrates were formed. The basic compounds were identified with the aid of a polarizing microscope and Debye-Scherrer diagrams. The course of the reactions involved and the respective solubilities are determined by the double salt. The entire system tends toward an equilibrium which involves the conversion of the anhydrous $3CaO \cdot Al_2O_3$ into $3CaO \cdot Al_2O_3 \cdot CaCl_2 \cdot 10H_2O$ to the maximum extent possible. In a series of experiments, the increase in the solubility of $Ca(OH)_2$ in aqueous solutions of NaCl of various concentrations at 20° was determined. The solubility at first rose steeply. Then the rise slowed down and seemed to approach a constant value. Similar experiments with KCl solution parallel the results obtained with NaCl solutions. M.Ho.

* **Critical analysis of cement calcination in a rotary kiln.** RUDOLF ZOLLINGER. *Zement*, **31** [41/42] 425–29; [43/44] 444–48; [45/46] 465–73 (1942).—A mineralogical and chemical analysis and the phase-diagram relationship involved in calcining cement are discussed. Bibliography. M.Ho.

* **Effect of fluxes (metal oxides and salts) on the fluidity and the electrical conductivity of Portland cement clinker glasses at 1300° to 1450° and its technical implications.** K. ENDELL AND G. HENDRICKX. *Zement*, **31** [37/38] 387–96; [39/40] 416–19 (1942).—The effect of SiO_2, Al_2O_3, Fe_2O_3, MnO, MgO, CaO, and Na_2O on the viscosity of the glassy mass of a cement clinker at 1400° was investigated. The composition of the clinker was CaO 50, Al_2O_3 34, Fe_2O_3 10, and SiO_2 6% by weight. The above oxides were added in amounts of 1 to 3%. SiO_2 and Al_2O_3 raised the viscosity. All the others caused a drop in the viscosity. The order of their effect on the decrease in viscosity of the glassy clinker was as follows: $Na_2O < CaO < MgO < Fe_2O_3 < MnO$. In the same order the temperature of equal viscosity is either raised or lowered. Experiments were also made with additions of CaF_2, $CaCl_2$, $MgCl_2$, and $CaSO_4$. All of these promote crystallization, and viscosity determination was made impossible. Electrical conductivity is determined entirely by the number of ions and the charge they carry. Since in the same weight there will be more light ions than heavier ones, the former will have a greater effect on the conductivity. At 1400° and for the same weight of added oxides, the conductivity increased in the following order: $CaO < Fe_2O_3 < MnO < Na_2O < MgO$. Small additions of CaF_2, $CaCl_2$, $MgCl_2$, and $CaSO_4$ lowered the conductivity. This is possibly due to the formation of small gas bubbles or crystal nuclei. The results of measuring the viscosity and electrical conductivity of the system $CaO–Fe_2O_3–SiO_2$ indicate that even a crystalline paste having a high internal friction still retains a considerable high electrical conductivity. This would seem to indicate that chemical reactions proceed at quite a rapid rate even after crystallization sets in. From the practical viewpoint of calcining cement, the results show that the sintering temperature can be lowered considerably by adding Fe_2O_3 or MnO. These additions, however, do not shorten the temperature interval of the pasty state lying between the liquid and the solid states. This pasty state interferes greatly with the calcining process because of the excess deposit which it causes. CaF_2 lowers the sintering temperature slightly, but the pasty state is shortened considerably by it. It is quite possible that $MgCl_2$, $CaCl_2$, and $CaSO_4$ have a similar effect. See "Fluidity. . .," *Ceram. Abs.*, **20** [5] 128 (1941). M.Ho.

* **Electron-microscopic investigation of cement.** W. EITEL. *Zement*, **31** [47/48] 489–95 (1942).—E. reviews the technique and methods used for studying cement in an electron microscope. See "Results. . .," *Ceram. Abs.*, **22** [1] 4 (1943). M.Ho.

* **Fusing of clinker minerals C_3A and C_4AF as well as the fraction $<3\mu$ of some Portland-cement clinker in a heated electron microscope.** M. VON ARDENNE AND K. ENDELL. *Zement*, **31** [29/30] 313–16 (1942).—The technique of fusing tricalcium aluminate and tetracalcium aluminoferrite in an electron microscope is described. Details are also given on fusing the fraction below 3 μ. The setup is described. The process was viewed under a 4000× magnification. M.Ho.

* **Mortar used in the construction of the Great Wall.** E. VON GRONOW. *Zement*, **31** [47/48] 495–97 (1942).—The mortar used by the Chinese for building the Great Wall contained sugar. It is known that sugar retards and may even prevent setting. G. points out that this indeed was the purpose of the sugar. It was intended to retard and regulate the too-rapid setting of lime mortar containing calcium aluminate. He proves this by pointing out the formation of $CaO \cdot Al_2O_3$ by reaction in the solid state. M.Ho.

* **Particle-size analysis of blast-furnace slags and cements, especially in the range below 10 μ.** F. GILLE. *Zement*, **31** [29/30] 316–19 (1942).—Two dispersing liquids, pyridine and quinoline, were investigated for the pipette analysis of fine-grained materials. The liquids proved entirely satisfactory for size analyses of slags and cements, as well as burned lime and slaked lime. For a falling distance of 20 cm., sizes up to 60 μ can be analyzed in quinoline and those up to 30 μ in pyridine. The latter, because of its low viscosity, requires short sedimentation time. It is also readily recovered for reuse. Quinoline, because of its greater viscosity, takes somewhat longer to reclaim, but it prevents coagulation more effectively. Quinoline permits determination down to colloidal sizes in cement. The rather long falling time for the very small size (below 1 μ) can be conveniently shortened by shortening the distance of fall. Particles above 60 μ are determined by sieve analysis. The size-distribution curve obtained by sieve, however, does not fit smoothly to the top of the curve obtained by the pipette method. Grinding experiments showed that dry ball milling (porcelain balls) is greatly hindered by the fines adhering to the balls and the walls of the mill. Sizes below 0.1 μ should hardly be expected in cements; the energy required to attain such sizes would be prohibitive. The possibility of wet grinding should be investigated. In such a case, quinoline could be used as a suspending liquid. The porcelain balls should

* Obtained from microfilm.

be replaced by a heavier material and made smaller. For the purpose of analysis, synthetic quinoline is preferable to quinoline derived from tar oil. In either case the quinoline should be dried over calcined K_2CO_3 and filtered. The dry residue is conveniently determined by evaporating a 10-ml. aliquot and gently igniting the residue. The use of quinoline for pipette analyses does not alter the procedure itself. To reclaim the used quinoline, the filtrates from the aliquots are collected in a bottle containing calcined K_2CO_3 and provided with a ground-glass stopper. The quinoline is vigorously shaken with the K_2CO_3. After the liquid clears, it is filtered through a fritted glass filter on which is placed coarse-grained K_2CO_3. The filtration is done under suction, and the quinoline is kept out of contact with atmospheric moisture. The filtrate is ready for reuse. M.Ho.

*** Particle-size range of small grains in ground Portland-cement clinker.** G. HAEGERMANN. *Zement*, **31** [43/44] 441–44 (1942).—An investigation of three kinds of clinker ground in a laboratory mill showed that the law of Rosin and Rammler for size distribution in a ground material holds down to at least 1 μ. The deviations from this rule for single fractions did not exceed 2%. Electron diagrams made by M. v. Ardenne and K. Endell show that the smallest particles are at least 0.12 μ. Particles of an average of 0.06 μ were found in a relatively coarse ground clinker. It is hoped that electron microscopy will be able to solve the question of the smallest particle, given properly prepared samples. M.Ho.

Plaster molds for precision nonferrous castings. H. F. HAGEMEYER. *Trans. Amer. Foundrymen's Assn.*, **50** [4] 1155–62 (1943).—According to evidence given by H., the use of plaster molds dates back to the 16th century and may even go back as far as the days of the Romans and Egyptians. Some of the properties of plaster which make it a suitable molding material for nonferrous castings are as follows: (1) It can be controlled to have only sufficient resistance to withstand the hydrostatic head of the liquid metal and will therefore not interfere with the shrinkage of the latter on cooling. (2) It can be thoroughly dried at an elevated temperature before the metal is poured. (3) It has satisfactory venting properties over the entire impression surface. (4) It allows a casting to be fed slowly enough so that practically no turbulence is produced, directional solidification is promoted, and all physical factors involved in the conversion can be mechanically controlled. H.E.S.

*** Progress in cement research in 1941.** C. R. PLATZMANN. *Zement*, **31** [39/40] 409–16; [41/42] 429–33; [43/44] 448–52; [45/46] 476–78 (1942).—P. reviews researches and advances made in cement. M.Ho.

*** Thermochemical investigation of the formation of Portland-cement clinker.** W. EITEL AND HARALD RICHTER. *Zement*, **31** [49/50] 505–13 (1942).—The purpose of this investigation was to determine the energy involved in the exothermal and endothermal reactions which take place in a cement calcined at 600° to 1000°. It is assumed that CO_2 and H_2O are not given off then. The adopted method was based on the determination of the heat of solution of the parent compounds and of the end products. The difference between the two would present the energy balance. For this purpose, samples of the parent compounds and of the end product (clinker) were dissolved in a suitable acid in a well-insulated calorimeter. The acid used was a mixture of 100 ml. of 0.24 *N* HF and 100 ml. of 2 *N* HNO_3. The temperature was measured with a Cu-constantan thermoelement and a mirror galvanometer. Reading the scale with an accuracy of 0.1 mm. gave a temperature sensitivity of 1.2×10^{-4} °C. The calorimeter, the auxiliary apparatus, their calibration, and the procedure of making determinations are described. The results are tabulated. References to the work of other investigators are included. M.Ho.

Use of cement in foundry molding. C. A. SLEICHER. *Trans. Amer. Foundrymen's Assn.*, **51** [3] 737–47 (1944).—The principles and reactions in the use of cement in foundry molding are explained. Reasons are given for the value of cement in molding, including lower material costs; savings in labor, fuel, and power; higher casting quality, etc. S. discusses the problems involved in the use of cement and gives the proper mixture, method of mixing, and drying time for cement molds, stressing the importance of the mold-blacking operation. H.E.S.

PATENTS

Plaster composition and process. M. C. DAILEY (United States Gypsum Co.). U. S. 2,341,426, Feb. 8, 1944 (Sept. 30, 1940).—An improved casting plaster comprising a mixture of finely comminuted alpha-gypsum, substantially all of the particles of which will pass through a 100-mesh screen, and finely comminuted normal pottery plaster.

Production of hydraulic cement compositions. SEMTEX, LTD., AND L. H. GRIFFITHS. Brit. 558,904, Feb. 9, 1944 (Sept. 3, 1942).

Enamel

Building codes and the porcelain enamel industry. B. L. WOOD. *Enamelist*, **21** [4] 9–10, 42–44 (1944).—W. points out the need for having porcelain enamel uniformly installed by competent and informed builders so that building inspectors may not condemn its use on the basis of occasional failures resulting from faulty installation. In a few cases building codes restrict porcelain enamel without intention, e.g., the specification of masonry or reinforced concrete construction for fire safety is overly stringent, the codes having been written prior to the development of porcelain enamel exteriors with light steel framing. Consideration of the use of porcelain enameled steel for the construction of residential chimneys also has been neglected in building codes. A number of organizations are now endeavoring to have building codes modernized in these respects. For the use of architects, W. advocates the establishment of basic minimum standards to be applied throughout the industry to govern all attachments and methods used in installing porcelain enamel. V.D.F.

Control of powdered-coal-fired melting furnaces. J. A. DURR. *Trans. Amer. Foundrymen's Assn.*, **51** [2] 312–26 (1943).—The fundamentals of the burning of powdered coal and the combustion are discussed. D. stresses the need for standardizing melting practice to meet present-day specifications and recommends frequent checks to insure uniform practice, giving a suggested order of standardization. H.E.S.

Cupola-air furnace duplex process for production of malleable cast iron. F. J. WURSCHER. *Trans. Amer. Foundrymen's Assn,*, **51** [2] 327–42 (1943).—Among the various systems employing the principle of duplex melting of metals, the combination of the cupola and the air furnace (reverberatory furnace) occupies a distinct and prominent place. In the malleable cast-iron industry, this method is finding increased adaptation because of its inherent economic features. Expounding the practices involved in the operation of this system, W. draws on his experience in the operation of such units over a period of several years and under varying premises. H.E.S.

Design and fabrication of sheet iron parts: I. ANON. *Enamelist*, **21** [4] 12–18 (1944).—This paper is the first in a series of articles presenting a refresher course in porcelain enameling. The information is presented in digest form based on material from "A Manual of Porcelain Enameling" (*Ceram. Abs.*, **17** [2] 59 (1938)). V.D.F.

14,722 Chicago housewives contribute to gas-range survey. ANON. *Amer. Gas Jour.*, **160** [1] 13–15 (1944).—A survey of modern gas ranges covering design, construction, and utilization changes for postwar requirements

* Obtained from microfilm.

showed the following results: 40-in. over-all width, all white color, low oven (36 in. high), high broiler, 4 burners, and drawer-type storage space. G.A.K.

Malleable annealing in the Dressler or tunnel-type kiln. R. J. ANDERSON. *Trans. Amer. Foundrymen's Assn.*, **50** [1] 50–66 (1942).—A. discusses completely the operation, advantages, and disadvantages of the tunnel-type kiln annealing furnace for malleable iron. The experience of the Belle City Malleable Iron Co. is outlined specifically. The choice of packing materials, construction of the kiln, methods of increasing or decreasing capacity, advantages and disadvantages of the tunnel kiln, and methods of overcoming disadvantages are discussed in detail. A. outlines (1) work done on his company's tunnel kiln to increase its efficiency during time of slack operation by construction changes and (2) the effect of the redesign of the kiln on temperature control, method of varying the annealing cycle under the conditions outlined, and the cost of operation. H.E.S.

Melting malleable iron with oil in the air furnace. A. VAN LANTSCHOOT. *Trans. Amer. Foundrymen's Assn.*, **51** [2] 343–64 (1943).—The oil-fired furnace is most efficiently operated with the least amount of air necessary for complete combustion. The top blast, or secondary air, is necessary in oil melting. Low air pressure and a low stack are desirable. Only one burner of simple design is used, and the oil is atomized by steam pressure. A flowmeter is indispensable for uniform results. Uniformity of operation and the ability to produce the desired composition as soon as the metal has attained the proper pouring temperature are outstanding advantages. Refractories are important, and simple service records covering the life of the bungs are kept because, in addition to giving valuable information, they stimulate the melter's interest in decreased refractory consumption. The effect of silicon and carbon on tensile strength is shown, and the most desirable silicon-carbon ranges are indicated. The effect of low carbon on shrinks is also discussed. H.E.S.

Methods for testing cleaner solutions. EDWARD C. SEABRIGHT. *Jour. Amer. Ceram. Soc.*, **27** [3] 90–95 (1944).—3 references, 8 figures.

1944 looks brighter. HENRY H. MORSE. *Finish*, **1** [1] 50–52, 58 (1944).—Improvements in the administration of the steel-rationing program and the gradual increase in the allotments of steel have eased the burden of the stove enamelers. V.D.F.

Planning for reconversion. ANON. *Enamelist*, **21** [3] 9–15, 28–29 (1944).—Points to consider in planning the reconversion of enamel plants are systematically discussed under the headings of the various operations. Model plant layouts are shown in diagrammatic form for continuous- and box-furnace processes. V.D.F.

Plant for low-temperature ceramic finishes. R. A. FLUM. *Finish*, **1** [1] 15–17, 54–56 (1944).—The process and equipment are described in detail from cleaning to firing. A special baffling system for spray booths, comprising a series of baffle plates hung vertically at the rear of the booth and staggered downward toward the back, produces a uniform flow of air at the booth opening. Details of the construction and temperature distribution of the continuous straight tunnel furnace are included. Illustrated. V.D.F.

Porcelain enamel industry studies new processes. ANON. *Bull. Amer. Ceram. Soc.*, **23** [3] 121–22 (1944).—1 photo.

Powder-enameling technique on cast iron. H. LANG. *Keram. Rundschau*, **49**, 186–88 (1941); abstracted in *Chem. Zentr.*, **1941, II** [6] 793.—The cold method and powdering are described Particulars of firing and furnace control for the powder method are given. See *Ceram. Abs.*, **21** [10] 209 (1942). M.V.C.

Proposed test for adherence of enamel to cast iron. W. C. CRESS AND H. G. FISK. *Bull. Amer. Ceram. Soc.*, **23** [3] 123–25 (1944).—5 figures, 2 references.

Simplification of pickle-room control. M. J. BOZSIN. *Enamelist*, **21** [4] 19–28 (1944).—Difficulty in testing pickling solutions in small plants is attributed to the confusion caused by chemical nomenclature among non-technical personnel. B. therefore proposes a system to eliminate chemical terms by substituting a set of numbers for the standard reagents and a series of letters to identify the apparatus. Full directions are given for methods of testing the cleaner solution, sulfuric and muriatic acid pickle baths, neutralizer, and nickle dip. Directions are also presented in chart form. A second chart is set up to serve as a model data sheet for periodic control. The preparation of the necessary reagents is described together with their numbers in the proposed scheme for simplification. V.D.F.

Study of "burnt-on" or adhering sand. J. B. CAINE. *Trans. Amer. Foundrymen's Assn.*, **51** [3] 647–705 (1944).—"Burnt-on" or adhering sand is an old problem encountered in all foundries, particularly in steel foundries. A severe case of adhering sand is often responsible for the scrapping of a sound casting. C. shows that "burnt-on" sand is the result of metal penetration of large voids in the sand, followed by freezing of the metal, which mechanically locks the sand to the casting. In a highly refractory sand, voids may be present on ramming as the result of large grain size. In less-refractory sands, voids may be formed by the fusing of the colloidal matter and finer silica particles present in the sand. Metal will penetrate either type of void provided the sand temperature is higher than the melting point of the casting alloy. Metal penetration may be reduced or prevented either by the formation of a continuous extremely viscous fused film such as results when hot metal strikes a properly applied silica wash or by gas pressure such as results when metal heats an organic binder incorporated in the sand mix. C. also discusses the effect of impurities which may be present in either the clay or the silica fraction of a sand mix. H.E.S.

Will we have one-coat porcelain enamel finishes applied directly to the base metal? G. H. MCINTYRE, F. R. PORTER, RICHARD H. TURK, GEORGE SIROVY, ANSON HAYES, AND B. T. SWEELY. *Finish*, **1** [1] 48–49 (1944).—Six enamelists, contributing their separate views of the subject, agree that the development of one-coat enamel finishes is a subject of prime importance. While one writer reports success with dark colors, the application to white and the lighter colors is still in the laboratory stage. V.D.F.

PATENTS

Enamelware and method of making. C. J. KINZIE AND C. H. COMMONS, JR. (Titanium Alloy Mfg. Co.). U. S. 2,340,884, Feb. 8, 1944 (April 11, 1941).—The method of making white vitreous enamelware with coatings less in weight than 40 gm. per sq. ft. and having a reflectance above 70 and substantially greater than that producible with the frit used and clay alone which comprises milling a mixture of a white frit 100 parts by weight having a basic reflectance above 60, clay, water, and not less than 10 parts by weight of an opacifier comprising a calcination product containing an oxide of a base-forming metal, antimony pentoxide, and an oxide from the group consisting of titanium and zirconium, the mixture being ground to a fineness where more than 95% by weight of the particles thereof are less than 44 μ in size to form the enamel slip, applying the slip to ground-coated ware in a thin film not exceeding 40 gm. per sq. ft. when fired, and firing the slip-coated ware at firing temperatures to produce the adherent vitreous enamelware.

Slip for enameling. J. E. ROSENBERG (O. Hommel Co.). U. S. 2,341,242, Feb. 8, 1944 (July 24, 1941).—In enamelware making, a slip compounded of frit together with a clay that carries an addition of a substance that, stable within the temperature range that is realized in drying, at the firing temperature of the ware gives off gas.

Glass

Ceria for glass polishing. CHARLES A. WEST. *Can. Chem. & Process Inds.*, **28** [1] 3–6 (1944).—Pure ceria may be prepared by heating sodium-free ammonium-hexanitrato-cerate, $(NH_4)_2Ce(NO_3)_6$, leaving the oxide. Constant weight is reached at 900°F. Various processes of heat-treatment of the ceria yield either a scratchy or a non-polishing product. Treatment at 1900°F. gives an oxide that polishes soft flint glass; at 2200° it polishes crown glass but scratches flint; at 2400° it scratches crown glass but polishes extra hard glass; at 2550° it scratches hard glass and becomes insoluble in HCl or HNO_3. Time of heating in the furnace and rate of cooling are unimportant factors. The use of ceria results in a saving of time, in fewer burns, in fewer "rolled edges," less aftercorrosion, and a more brilliant polish. B.L.

Colored glasses: I, Constitution of colored glasses. WOLDEMAR A. WEYL. *Jour. Soc. Glass Tech.*, **27** [122] 133–206T (1943).—This monograph was prepared for the Society of Glass Technology under the provisions of the Glass Research Assn. Trust. Subjects discussed are as follows: (1) Origin of color in inorganic substances: (*a*) inorganic chromophores, (*b*) influence of solvation, adsorption, and temperature. (2) Constitution of glass: (*a*) general review of the problem, (*b*) ions as the building units of glasses, (*c*) principles governing the ionic structure of crystals and glasses, (*d*) atomic structure of silica glass, binary and ternary silicate glasses, boric oxide-containing glasses, and phosphate glasses, (*e*) role of Al_2O_3, BeO, ZnO, and TiO_2 in glasses. (3) Replacement of oxygen by other elements in glasses: (*a*) sulfur and selenium as substitutes for oxygen, (*b*) halogen ions as substitutes for oxygen. (4) Acidity and basicity of glasses. (5) Classification of glasses according to their chromophores: (*a*) colored glasses with one coloring ion, with chromophore groups consisting of two ions, and with chromophore groups consisting of three ions. (6) Constitution of glasses as revealed by color and fluorescence indicators: (*a*) determination of the state of oxidation, acidity, and basicity of a glass by the indicator method, (*b*) determination of the coordination number of an ion, (*c*) indicators for the general electric perturbation of an ion. (7) Fluorescence indicators. R.H.B.

*** Damage through freezing and other causes to the cover glasses of water meters with rotating vanes.** R. ELLWANGER. *Gas- & Wasserfach*, **86** [15] 182–83 (1943).—The municipal water works of Stuttgart investigated the causes of damage by frost or excess pressure and found that covers of hard glass are much more resistant than those of pressed glass; the ratio was about 1:4. Proper care in the location of the meters and draining during very hard winter days are recommended for eliminating this kind of damage. M.HA.

Devitrification characteristics of alkali-lead oxide-dolomite lime-silica glasses. J. F. WHITE AND W. B. SILVERMAN. *Jour. Amer. Ceram. Soc.*, **27** [3] 81–85 (1944).—3 references, 4 figures.

Optical topics in part connected with Charles Parsons. RAYLEIGH. *Nature*, **152** [3867] 676–82 (1943).—R. traces the development of the telescope by Charles Parsons' father and of searchlight mirrors by Parsons. He also discusses Newton and the dark lines of the solar spectrum and the telescope and spectroscope without lenses. Photographs of the solar spectrum showing Fraunhofer lines are given. G.A.K.

Polariscopic examination of glass-container sections. GLASS CONTAINER ASSOCIATION RING SECTION SUB-COMMITTEE OF THE STANDARD TESTING PROCEDURE COMMITTEE. *Jour. Amer. Ceram. Soc.*, **27** [3] 85–89 (1944).—11 references, 1 figure.

Simple glass-blowing machine. C. E. S. PHILLIPS. *Jour. Sci. Instruments*, **21** [1] 17–18 (1944).—P. describes a laboratory glass-blowing machine designed for certain glass-blowing jobs which often arise in a laboratory and normally require skill and experience. It was made largely from scrap material and provides a means of supporting horizontal glass tubing at each end and revolving it slowly and evenly while heat from a gas flame is applied at one or more points, with provision for blowing into the tube if required. It is also possible to shorten or draw out the glass tubes and to handle tubing of various diameters and lengths. Illustrated. G.A.K.

* Obtained from microfilm.

BOOK

Optical Workshop Principles. CHARLES DÉVÉ. Translated by Thomas L. Tippell. Adam Hilger, Ltd., London, 1943. xiv + 306 pp., 120 illustrations. Price 20s, postage 9d extra. Obtainable in U. S. from Jarrell-Ash Co., 165 Newbury St., Boston, Mass., price $6.00.—This translation of "Le Travail des Verres d'Optique de Précision" (*Ceram. Abs.*, **18** [2] 49 (1939)) has been chosen for publication as an outstanding exposition of the practice in the production of optical surfaces at the date of publication of the French edition (1936). In it D. sets forth not only the practical manipulations by the worker and the adjustments of machines but also the theoretical basis for his recommendations. Chapters are devoted to testing of raw material and work in progress; to the cutting, grinding, and polishing of crystals; to centering, edging, and cementing; to engraving; and to metallization. The production of aspherical surfaces is treated in some detail. Special attention is paid to the actual technique of optical glass-working. Little space is given to detailed descriptions of machines, but stress is laid upon those fundamental processes which form the basis of all good workshop practice and on the theoretical reasons which govern the proper application of such processes. Similarly, the testing methods described are those employed in the workshop in the course of manufacture rather than those used in the testing laboratory. For those interested in the mechanical and mathematical analysis of the underlying processes, there is a chapter which will well repay the study it requires. The result is a book which is of absorbing interest to all engaged in optical glasswork and a very valuable guide to the perfection of the technique they practice. It may be read with profit by anyone using, or intending to use, optical methods of producing flat or curved surfaces.

PATENTS

Alloy for metal-to-glass seals, etc., and method of producing it. V. O. ALLEN AND J. F. POLAK (Wilbur B. Driver Co.). U. S. 2,343,038, Feb. 29, 1944 (Dec. 19, 1941).

Apparatus for scoring cover glass. T. G. WEIHS, now by legal change of name T. G. White (American Window Glass Co.). U. S. 2,343,035, Feb. 29, 1944 (Dec. 16, 1941).

Apparatus for use in tempering glass. GERALD WHITE (Libbey-Owens-Ford Glass Co.). U. S. 2,343,490, March 7, 1944 (April 4, 1940).

Carbonaceous coating for glass fibers. H. N. JONES (Owens-Corning Fiberglas Corp.). U. S. 2,341,219, Feb. 8, 1944 (Dec. 6, 1940).

Coated noninflammable glass fabric. C. S. HYATT AND T. J. KERR (Columbus Coated Fabrics Corp.). Can. 417,668, Jan. 11, 1944 (Dec. 4, 1940; in U. S. Oct. 21, 1940). G.M.H.

Coloring of vitreous fibers or of fabrics produced therefrom. E. C. MAXWELL, U. C. MAXWELL, AND G. BARKER. Brit. 559,068, Feb. 16, 1944 (June 29, 1942).

Combined glass dish and cover plate. LOUIS POGLEIN (McKee Glass Co.). U. S. 2,342,486, Feb. 22, 1944 (April 9, 1941).

Combined machine for surface grinding and polishing glass, etc. DAVID BEZBORODKO AND CHARLES ZUCKER (vested in the Alien Property Custodian). U. S. 2,341,524, Feb. 15, 1944 (May 27, 1941).

Forming of structural glass. F. W. PRESTON. U. S. 2,342,218, Feb. 22, 1944 (March 7, 1942).

Glass breakage minimizing method. F. B. WALDRON AND J. H. GRIFFIN (Pilkington Bros., Ltd.). Can. 417,591,

Jan. 4, 1944 (March 10, 1942; in Great Britain April 24, 1941). G.M.H.

Lens. G. H. AKLIN (Eastman Kodak Co.). U. S. 2,343,627, March 7, 1944 (Oct. 8, 1941). F. E. ALTMAN (Eastman Kodak Co.). U. S. 2,343,629, March 7, 1944 (May 11, 1942).

Lens blank and lap mounting. A. J. HOLMAN (Bausch & Lomb Optical Co.). Can. 418,144, Feb. 1, 1944 (Dec. 11, 1942; in U. S. Dec. 12, 1941). G.M.H.

Manufacture of glass headers for electron tubes. B. S. ELLEFSON (Sylvania Electric Products, Inc.). U. S. 2,342,609, Feb. 22, 1944 (Nov. 12, 1940).

Mechanism for generating curved surfaces, particularly adapted for lens grinding. BAUSCH & LOMB OPTICAL CO. Brit. 558,549, Jan. 19, 1944 (Dec. 12, 1941).

Nonplastic material molding method. F. A. BICKFORD (Corning Glass Works). Can. 418,157, Feb. 1, 1944 (May 28, 1942). G.M.H.

Process for sheet-glass manufacture. M. A. POWERS. U. S. 2,342,891, Feb. 29, 1944 (Dec. 19, 1938).

Protecting plate glass in storage. D. L. WRIGHT (Standard Oil Development Co.). U. S. 2,340,918, Feb. 8, 1944 (Nov. 14, 1939).—A process of protecting glass surface from the formation of iridescence which comprises coating the glass surface with a composition consisting of petroleum oil having a volatility less than that of gasoline and a Saybolt viscosity less than 1000 seconds at 100°F., 2 to 30% oil-soluble sulfonate, and 2 to 30% fatty oil.

Reflection-reducing layers on glass. RADIO CORP. OF AMERICA. Brit. 558,098, Jan. 5, 1944 (March 1, 1941).

Tempered hollow glass article. H. R. KIEHL (Corning Glass Works). Can. 417,674, Jan. 11, 1944 (Nov. 15, 1941; in U. S. Jan. 29, 1941). G.M.H.

Uniting of metal to and sealing metal into vitreous and ceramic materials by heat. ANGLO-IRANIAN OIL CO., LTD., E. W. M. FAWCETT, AND T. W. J. RICHES. Brit. 558,202, Jan. 5, 1944 (June 26, 1942).

Refractories

Acid open-hearth practice for steel castings. C. W. BRIGGS AND G. S. BALDWIN. *Trans. Amer. Foundrymen's Assn.*, **50** [4] 1104–33 (1943).—The methods used in operating the open-hearth furnace by the acid practice are outlined. Lining and bottom construction, charging and melting, slag control, and finishing methods are discussed. Slag analyses and furnace logs are given. H.E.S.

Action of alkalis on refractory materials. F. H. CLEWS, H. M. RICHARDSON, AND A. T. GREEN. *Bull. Brit. Refrac. Research Assn.*, No. 54 (May, 1940); No. 57 (Nov., 1940); No. 61 (Nov., 1941); reprinted in *Trans. Brit. Ceram. Soc.*, **42** [11] 209–20 (1943); see *Ceram. Abs.*, **21** [10] 212 (1942). R.A.H.

Blast-furnace metallurgy. C. D. SMITH. *Steel*, **112** [13] 86–92 (March 29, 1943).—More and better-quality iron may be produced through the medium of blast-furnace operations by applying the maximum blast, using the lowest practical molar basicity, using 100% washed coal for coke, close control of operating temperatures, keeping scrap additions within the indicated percentages, and using the best raw materials obtainable. M.A.S.

Chrome ore and chrome magnesite. J. H. CHESTERS. *Iron Age*, **152** [20] 68–71; [21] 52–55, 166, 168 (1943).—Some chrome ores unsuitable for ferrochrome or for the chemical industries are satisfactory for refractories. Any addition of magnesia to chrome ore raises its melting point, which for the pure material is about 4175°F. When chrome ore is fired at a high temperature, the gangue melts and is redistributed. Some brick manufacturers prefer such prefired ores. Chrome ores, under X-ray examination, show peculiar variations in orientation and size of crystals. Straight chrome brick tend to soften under firing. Chrome-magnesite brick may be chemically bonded and used without firing or may be fired in the normal way. Firing temperatures vary greatly, finishing temperatures ranging from 2460° to 3000°F. Composite refractories include combinations of chrome with silica, alumina, dolomite, and olivine. Chrome-bearing cements have given good service, but chrome has sometimes contaminated special steels. Lengthy bibliography. E.H.McC.

Conservation of foundry refractories. C. E. BALES AND F. MCCARTHY. *Trans. Amer. Foundrymen's Assn.*, **51** [3] 763–72 (1944); see *Ceram. Abs.*, **22** [10] 175 (1943). H.E.S.

Cupola-electric furnace duplexing of malleable iron. CHARLES MORRISON. *Trans. Amer. Foundrymen's Assn.*, **51** [2] 277–311 (1943).—M. stresses the fact that the electric furnace is not intended to be a means of obtaining any appreciable reduction of carbon in the iron but that it is to be used as a holding furnace. The success of the process depends on good control of the cupola melting conditions and the raw material used. M. describes the duplexing operation, giving typical cupola charges, and discusses blast humidity control, the hot blast, tuyère design, carbon absorption, effect of raw materials on the nature of the metal, cupola and forehearth maintenance, metal control, refractory life and maintenance, temperature control, and chemical analysis of the iron. H.E.S.

Design of a front slagging cupola spout. R. D. PETCHER. *Trans. Amer. Foundrymen's Assn.*, **51** [3] 706–708 (1944); *Amer. Foundryman*, **6** [1] 7–8 (1944).—The details of a front slagging spout are presented and illustrated. The molten metal and slag are carried together through the cupola breast or tap hole into a trough. The metal then flows under a slag dam, while the slag floats on the metal and runs off at the side of the spout into a slag ladle. The clean metal then flows over the lip of the spout into a receiver from which it is distributed, by means of conventional transfer ladles, to the molding floors. H.E.S. & M.A.S.

Dolomite refractories. J. H. CHESTERS. *Iron Age*, **152** [6] 48–53; [7] 86–89, 150 (1943).—Dolomite is widely distributed and can be substituted for magnesite in many parts of furnaces. One objection is that calcined dolomite absorbs moisture and is not stable. In America, dolomite is often calcined in rotary kilns, with an addition of iron oxide to increase stability and expedite sintering. The constitution of clinker is best studied by the X ray. Thermal conductivity at 1832°F. mean temperature is about 15 B.t.u. (25 for magnesite). Specific heat over 68° to 1402°F. is 0.255, and thermal expansion is about 1.3%. Slag resistance, with iron oxide and lime slags, is lower than that of magnesite. In preliminary experiments, stabilized dolomite clinker has shown some merit as a basic ladle lining. C. includes an extensive bibliography. E.H.McC.

Evaluation of the properties of high-temperature insulating materials. L. R. BARRETT, F. H. CLEWS, AND A. T. GREEN. *Bull. Brit. Refrac. Research Assn.*, No. 65 (June, 1940); reprinted in *Trans. Brit. Ceram. Soc.*, **42** [11] 220–34 (1943); see *Ceram. Abs.*, **21** [1] 14 (1942). R.A.H.

Magnesia from sea water. P. PARISH. *Chem. Age* [London], **50** [1280] 28–29 (1944).—The production of magnesia from sea water, although simple in principle, involves much ingenuity in its industrial operation. Generally, pretreatment with lime is necessary to remove bicarbonate and sulfate before the magnesia is precipitated by treatment with pure lime or calcined dolomite. The advantages of using dolomite are as follows: (1) the yield from a given quantity of water is almost doubled; and (2) the magnesia particles, by acting as nuclei for precipitation, affect the physical condition of the precipitate. Local availability, however, is usually the deciding factor in the choice of the precipitant. The plant for precipitation, comprising flocculators, thickeners, and vacuum filters, calls for special design, since many factors influence the

physical character of the precipitate and the rate of output. Methods of treatment of the precipitated magnesium hydroxide vary according to local circumstances or the purpose for which the magnesia is required. The filter cake may be calcined in rotary kilns, or a more reactive caustic magnesia may be prepared by the electrolytic process. The processes of Brit. Pat. 548,197 (*Ceram. Abs.*, **22** [1] 12 (1943)), U. S. Pat. 2,276,245 (*ibid.*, **21** [5] 103 (1942)), and U. S. Pat. 2,273,178 (*ibid.*, [4] 84) are described. A.B.S.

Magnesite refractories. J. H. CHESTERS. *Iron Age*, **151** [22] 46–51; [23] 75–81 (1943).—The world's sources of raw material fall roughly in 5 groups: (1) spathic or coarsely crystalline magnesite, (2) submicroscopic or "compact" magnesite, (3) breunnerite, which is a solid solution of magnesium and ferrous carbonates, (4) brucite, and (5) sea-water magnesia. C. discusses specific sources, properties, and effects of firing. Grinding and grading are important. Magnesite brick are usually made by mixing graded clinker with water or dilute sulfite lye. Additions are made for special purposes, such as iron oxide for density of texture or 2 to 6% of alumina to increase resistance to thermal shock. Thermal conductivity is about 25 B.t.u. at 1830°F. mean temperature. Thermal expansion is about 1.2 to 1.4% for temperatures of 70° to 1830°F. Electrical conductivity is low at room temperature but increases considerably with high temperatures. Slag resistance is remarkably high. C. includes specifications and a lengthy bibliography. E.H.McC.

*** Making alumina cement from synthetic bauxite.** A. W. SCHMIDT, L. STUCKERT, AND S. G. FENG. *Zement*, **31** [33/34] 353–56 (1942).—Synthetic bauxite was produced from kaolin or clay calcined at 800° to 1100°. The product is leached with a dilute alkali solution, thus concentrating the alumina. A product containing SiO_2 26.95, Al_2O_3 70.31, and Na_2O 2.25% was obtained by this method. This product was mixed with CaO in a ratio of 60:40. The mix was calcined in a laboratory furnace at 1280° to 1300° for 2 to 8 hr. The cement thus produced consisted of Al_2O_3 38.2, CaO 44.5, SiO_2 16.2, and Na_2O 1.0%. By varying the proportions, other cements were prepared. A cement containing Al_2O_3 44.5, CaO 40.5, SiO_2 11.0, and Na_2O 2.0% was used for testing. Strength tests showed that this cement was inferior to the usual aluminous cement. Experiments were then made by adding Al_2O_3 and Fe_2O_3 to the synthetic bauxite cement. An addition of Fe_2O_3 in quantities not exceeding 6% of the mix improved the product considerably. This addition gave a cement 25% stronger than the cement without this addition, and it attained 90% of the average strength of usual aluminous cements. It also closely resembled the aluminous cements in its color and other properties. Commercial aluminous cements and synthetic bauxite cement differed mainly in crystal size. Under normal production conditions, a product may be produced having a finer crystalline structure than it was possible to achieve in the laboratory. A finer crystalline structure is likely also to improve the strength properties of aluminous cement made from synthetic bauxite. M.Ho.

Malleable foundry refractory practice. C. A. BRASHARES. *Trans. Amer. Foundrymen's Assn.*, **51** [2] 401–16 (1943).—The refractories used in the cupola, air furnace, acid electric furnace, and open-hearth furnace as employed in the production of malleable iron are discussed. The special application of silica brick in cupola linings is presented. High-alumina brick containing crystalline alumina were used in certain sections of air-furnace linings. Refractory practice for the auxiliary equipment, such as forehearths, ladles, and annealing ovens, is also included. H.E.S.

New kink in repairing open-hearth bottoms. J. D. SAWYER. *Steel*, **112** [10] 116–18, 139 (March 8, 1943).—A new method for setting an open-hearth bottom by dumping a charging box of liquid slag from a nearby furnace on the patch in question is discussed. Methods of other operators are also included. M.A.S.

* Obtained from microfilm.

Open-hearth construction with basic brick. H. M. GRIFFITH. *Blast Furnace & Steel Plant*, **32** [1] 83–84 (1944).—All-basic construction (except the main roof) has the advantages of fewer minor repairs and improved efficiency. The slag, which is in granular condition, may be raked out while the furnace is in operation. An experimental furnace with one end basic and one silica is described. B.L.

Proper grinding and inspection of tool steels. J. E. ERB. *Iron Age*, **151** [2] 28–32 (1943).—Cracks, both visible and invisible, in tool steel are caused primarily by improper grinding. Improper grinding may also result in softening. Vigorous grinding of annealed high-carbon steels may cause hardening by raising the surface of the metal to a red heat which is followed by sudden chilling because of the mass of cold metal beneath or the flushing of the grinding coolant. E.H.McC.

Refractories in the nonferrous foundry under war conditions. M. H. BERNS, *Trans. Amer. Foundrymen's Assn.*, **51** [2] 481–86 (1943).—Modern metal demand requires that the best refractories available be used in every nonferrous melting furnace. The relationship of furnace requirements to the properties of common refractories is discussed with the aid of a chart showing such properties. H.E.S.

Refractory realization in 1943. ADRIAN G. ALLISON. *Blast Furnace & Steel Plant*, **32** [1] 85–88 (1944).—Current trends in supplies and uses are outlined. B.L.

Silica and semisilica refractories. J. H. CHESTERS. *Iron Age*, **151** [3] 36–41; [4] 44–49 (1943).—The expansion characteristics of a silica brick are a function of the amount and nature of the silica modifications present. If brick contains appreciable amounts of raw quartz, growth will take place when it approaches a temperature above that at which it was fired. When cristobalite passes through its inversion at 390° to 570°F., it undergoes an expansion of about 0.5%; furnaces with silica brick, therefore, should be heated slowly through this range. A review of raw materials and manufacture in various countries presents a tentative specification that no brick should be above 2.38 in specific gravity. Some service tests indicate an advantage in brick with no added bond. Mottling of brick does not always indicate inferior quality. The steel industry uses many semisilica or sand brick which are cheaper and are more highly resistant to thermal shock and to penetration by molten slags. 100 references. E.H.McC.

Steel-plant refractories problems. LOUIS A. SMITH. *Blast Furnace & Steel Plant*, **32** [1] 104–108 (1944).—A cooperative study of refractories from the steel man's viewpoint is suggested. B.L.

SEPARATE PUBLICATIONS

Industrial Insulation with Mineral Products. OLIVER BOWLES. *U. S. Bur. Mines Information Circ.*, No. 7263, 17 pp. Free.—B. discusses the properties of insulating materials, including mineral wool, asbestos, basic magnesium carbonate, vermiculite, diatomite, etc. R.A.H.

Thermal Analysis of Clay Minerals and Acid Extraction of Alumina from Clays. JOSEPH A. PASK AND BEN DAVIES. *U. S. Bur. Mines Rept. Investigations*, No. 3737, 28 pp. Free.—The chemical and thermal analyses of known clay minerals were studied to determine characteristics by which they may be identified. Available or acid-soluble alumina content and percentage extraction were determined by a method developed by the Bureau of Mines. The pressure digestion method was also used on several samples; this offers possibilities for further study. R.A.H.

PATENTS

Alumina insulating material. F. H. RIDDLE (Champion Spark Plug Co.). Can. 417,661, Jan. 11, 1944 (Oct. 28, 1940; in U. S. May 13, 1940). G.M.H.

Bonded silicon carbide refractory. J. P. SWENTZEL (Carborundum Co.). Can. 417,825, Jan. 18, 1944 (Oct. 3, 1941; in U. S. Sept. 25, 1940). G.M.H.

Cast refractory product. T. E. FIELD (Corhart Refractories Co.). Can. 417,673, Jan. 11, 1944 (Oct. 1, 1940; in U. S. Oct. 20, 1939). G.M.H.

Foundry mold composition. D. S. HAKE AND W. G. WELLINGS (Titanium Alloy Mfg. Co.). Can. 417,475, Dec. 28, 1943 (March 9, 1942). G.M.H.

Heat-cast refractory. T. E. FIELD (Corhart Refractories Co.). Can. 417,384, Dec. 28, 1943 (March 13, 1941).—A heat-cast refractory contains chromic oxide and an alkaline-earth oxide and is substantially free from alumina and silica. **Can. 417,385,** Dec. 28, 1943 (March 13, 1941).—A heat-cast refractory consists essentially of ferrous chromite and is substantially free from compounds other than those of the metals forming the chromite. **Can. 417,386,** Dec. 28, 1943 (March 13, 1941).—A heat-cast refractory is substantially free from silica and consists essentially of ferrous chromite and at least one of the alkaline-earth chromites. **Can. 417,387,** Dec. 28, 1943 (March 31, 1941).—A heat-cast refractory consists essentially of iron oxide, alumina, and chromic oxide without any substantial amount of magnesia and silica. G.M.H.

Hot top. B. F. ANTHONY (Ferro Engineering Co.). U. S. 2,341,589, Feb. 15, 1944 (July 30, 1942).

Porous refractory. C. J. KINZIE AND EUGENE WAINER (Titanium Alloy Mfg. Co.). U. S. 2,341,561, Feb. 15, 1944 (May 16, 1940).—The method of making a refractory structure of high porosity which comprises thoroughly mixing zircon with a permanent bonding agent in the presence of an aqueous liquid, subsequently adding to the batch a granular organic solid, shaping the mass, drying, and firing at an elevated temperature.

Processing dolomite. W. H. MACINTIRE (American Zinc, Lead & Smelting Co.). U. S. 2,343,151, Feb. 29, 1944 (Aug. 3, 1940).—A method of processing dolomite which comprises pulverizing dolomite, adding thereto silica in an amount approximately 1.07 parts by weight of silica to 1 part of CaO contained in the dolomite, and calcining the mixture at a temperature of approximately 850° to 1000°C., with agitation, until substantially all of the calcium and magnesium carbonates contained in the dolomite are converted, respectively, into calcium silicate and magnesium oxide.

Recovering magnesium salts. S. B. HEATH AND F. R. MINGER (Dow Chemical Co.). U. S. 2,342,666, Feb. 29, 1944 (Aug. 5, 1942).—A method of treating sea water to recover magnesium salts therefrom as substantially pure magnesium chloride.

Recovering magnesium from sea water. AFRICAN SISAL & PRODUCE CO., LTD., C. L. WALSH, AND R. J. BROWNE. Brit. 558,882, Feb. 9, 1944 (March 10, 1943).

Refractory zirconia-alumina casting. G. S. FULCHER AND T. E. FIELD (Corhart Refractories Co.). Can. 417,672, Jan. 11, 1944 (Oct. 1, 1940; in U. S. Oct. 24, 1939). G.M.H.

Refractory zirconia casting. G. S. FULCHER AND T. E. FIELD (Corhart Refractories Co.). Can. 417,670 and 417,671, Jan. 11, 1944 (Oct. 1, 1940; in U. S. Oct. 11, 1939). G.M.H.

Sectionally supported wall. P. W. ANTILL (American Arch Co.). U. S. 2,341,971, Feb. 15, 1944 (Dec. 13, 1940).

Whiteware

Glazed earthenware may be used for bathtubs. ANON. *Science News Letter,* **45** [1] 4 (1944).—Vitreous glazed earthenware bathtubs have greater strength and durability and do not develop dirt-gathering cracks to mar the appearance. G.A.K.

Second war standard in series covers steatite radio insulators (C75.2—1943). H. R. WILSEY. *Ind. Standardization,* **14** [10] 273–75 (1943).—Steatite insulators are made from talc or soapstone, a flux, and sometimes clay. The insulator has a low power factor and a low dielectric loss factor. Nonuniform manufacturing methods and nonuniform requirements for identical insulators have caused trouble. After careful study, a standard was adopted which gives procurement methods, standard practices, manufacturing tolerances, etc. See "New. . .," *Ceram. Abs.,* **22** [11] 191 (1943). W.D.F.

Talcs for use in radio ceramic insulators. T. A. KLINEFELTER, R. G. O'MEARA, RICHARD W. SMITH, AND GLENN C. TRUESDELL. *Amer. Inst. Mining & Met. Engrs. Tech. Pub.,* No. 1606; *Mining Tech.,* **7** [5] 5 pp. (1943).—A dense steatite porcelain is far better than even high-tension electrical porcelain for high-frequency work. An investigation was made of the national talc resources in search of a grade suitable for use in the manufacture of radio ceramic insulators. Only a few firms were making the kind of insulators wanted, and virtually all of the talc used by them came from one locality. Other sources would be necessary to meet the greatly increased demands. Samples were obtained from all of the talc-producing states and subjected to a series of tests. The preliminary testing consisted in assays for the impurities of lime and iron, a microscopic examination to determine the type of mineralization in which the impurities were present, and a flotation test, if necessary. A few talcs in various localities are of the proper grade as they occur, but most of the samples require some beneficiation; usually, however, this can be accomplished with fair recovery. W.D.F.

PATENTS

All-ceramic denture and method of producing. P. W. LEE AND CHARLES DIETZ (Dentists' Supply Co. of New York). U. S. 2,341,998, Feb. 15, 1944 (May 31, 1939; July 9, 1940).—A denture base ceramic body for attachment in fused relation to a tooth ceramic body, the base ceramic body containing substantially 65 to 80% feldspar, 10 to 20% amorphous silica, and 5 to 15% borax glass and the base comprising the ingredients in such proportions that the thermal contractions of the bodies through a range extending at least from the freezing point of the base to atmospheric temperature are in substantial harmony, the base having a fusing point of approximately 1500° to 1600°F.

Arrangement to raise the breakdown strength of insulators. WILHELM PETERS (vested in the Alien Property Custodian). U. S. 2,343,078, Feb. 29, 1944 (Dec. 13, 1940).

Ceramic insulator. R. D. BÜGEL (Philips Lamps, Ltd.). Can. 418,174, Feb. 1, 1944 (Feb. 24, 1940). G.M.H.

Making spark plugs. GENERAL MOTORS CORP. Brit. 558,405, Jan. 19, 1944 (Feb. 9, 1942).

Metal-to-porcelain seals. BRITISH THOMSON-HOUSTON CO., LTD. Brit. 558,410, Jan. 19, 1944 (Dec. 18, 1941).

Spark plug. FRED KAPP. U. S. 2,340,963, Feb. 8, 1944 (April 6, 1942). C. M. CARINGTON AND G. W. SHOOBERT. U. S. 2,342,360, Feb. 22, 1944 (Nov. 20, 1942). GENERAL MOTORS CORP. Brit. 558,497, Jan. 19, 1944 (Aug. 22, 1941). W. W. CONSTANTINE (General Motors Corp.). Brit. 558,976 and 558,977 (divided out of 558,976), Feb. 9, 1944 (Aug. 27, 1942).

Teapots, etc., and their manufacture. W. T. COPELAND & SONS, LTD., AND A. WOOLLAM. Brit. 558,911, Feb. 9, 1944 (Oct. 27, 1942).

Equipment and Apparatus

Crystal structure and wear-resisting properties of metals. ANON. *Mech. World & Eng. Record,* **113** [2940] 498–99 (1943).—Present knowledge of the relationship between homogeneity and hardness is discussed. The crystal properties and the strength of the crystals in mass as well as hardness and crystalline structure are considered.

Homogeneity appears to be ideal from the crystallographic viewpoint, and when homogeneity is combined with hardness, good wearing properties can be expected. The obvious exception is the white bearing metal in which homogeneity is characteristic and in which large hard cubic particles of tin-antimony or its equivalent are found. P.G.

Development of high-temperature radiant tubes. ANON. *Amer. Gas Assn. Proc.*, **23**, 427 (1941).—It is hoped that radiant tubes may be developed which will be capable of operating in furnaces at temperatures above 1850°F. Metallic alloys do not withstand these higher temperatures, and search for a ceramic substitute has not been productive to date. The search is continuing, and enough preliminary work has been done to confine future work to a firm scientific basis. M.R.

Electron microscope. M. C. BANCA. *Can. Chem. & Process Inds.*, **28** [1] 10–12 (1944).—B. gives the principles of operation, describes the mounting of specimens, and mentions some applications in the study of fine crystals. B.L.

Industrial fans and their applications. M. S. KICE. *Steel*, **112** [11] 110–12 (March 15, 1943).—Fan efficiency is discussed. M.A.S.

Infrared drying with gas. ANON. *Steel Processing*, **30** [2] 109–10 (1944).—An account is given of the operation of refractory-type gas infrared burners in paint drying and the results obtained. 2 photographs. See "Radiant. . .," *Ceram. Abs.*, **22** [11] 197–98 (1943); "Near...," *ibid.*, **23** [2] 41 (1944). M.R.

Infrared lamps dry green-sand molds for war castings. L. M. DURYEE. *Trans. Amer. Foundrymen's Assn.*, **51** [1] 253–60 (1943).—The use of infrared lamps to dry green-sand molds is described. A considerable saving in time and labor is effected, and uniform drying and penetration are obtained. H.E.S.

*** New nomograph for the calculation of reinforced concrete.** L. GELLUSSEAU. *Génie Civil*, **119** [23] 277–79 (1942).—The required sections and dimensions of a reinforced concrete structure under tension, compression, and bending stresses can be determined by a nomograph. M.HA.

Plans and specifications for a small Globar kiln. EDGAR LITTLEFIELD. *Bull. Amer. Ceram. Soc.*, **23** [3] 125–26 (1944).—1 figure.

Radio-frequency heating. ANON. *Elec. Rev.*, **134** [3454] 163 (1944).—Radio-frequency heating and its industrial applications are discussed. Three classes of such heating are considered: (1) eddy-current heating, (2) capacity-current heating, and (3) radio-frequency heating. Its uses include plastics production, food dehydration, the manufacture of thermionic valves, heat-treating, and the heating of small articles. M.R.

Soil-moisture meter. L. A. RICHARDS AND L. R. WEAVER. *Jour. Amer. Soc. Agron.*, **35** [12] 1002-11 (1943).—A porous ceramic sorption block is used as a moisture meter. Data on the hysteresis effect for six soils are given. W.R.B.

Subsieve sizer, a new instrument, measures small particles. ANON. *Laboratory*, **14** [3] 63–65 (1943).—The instrument uses the air-permeability method. Constant-pressure air flows through the sample, and the difference in pressure is measured on a manometer. By using a sample weight in grams equal to its true density and a standard packing method, it is possible to remove variables from the air-permeability equation. By the use of a special calculator chart, the particle size may be obtained directly from the manometer reading. See "Simplified. . .," *Ceram. Abs.*, **23** [2] 42 (1944). W.D.F.

***Surface electron microscopy of glass and ceramics by the imprint method.** E. GÖLZ. *Z. Tech. Physik*, **24** [1] 8–11 (1943).—A fine film of lacquer is condensed from vapor or directly brushed on the surface to be examined and, after careful removal from the surface, is placed in the electron microscope. Differences in the height of the surface of up to 10 mμ are reproduced in the film without any distortion. Directions are given for making and removing films from fractured areas, surfaces produced by liquid and vaporous etching agents, and polished surfaces. Numerous electron pictures are reproduced. M.HA.

Temperature measurement of molten cast iron with the "rayotube" and optical pyrometer. R. H. KOCH AND A. E. SCHUH. *Trans. Amer. Foundrymen's Assn.*, **50** [4] 1163–84 (1943).—For measuring temperatures of molten cast iron, an instrument, to perform under actual shop conditions, must have accuracy, precision, ruggedness, ease of calibration, and economic operation. The results of an intensive investigation of instruments to meet these requirements are described. An adaptation of the rayotube instrument, coupled with an appropriate recorder, was developed to measure the temperature of the molten metal continuously discharging into front slagging cupola spouts. The instrument, measuring the total radiation emitted from an immersed refractory tube, is described, together with its operation. It met all the above requirements for the measurement of the true temperature of molten cast iron. A further adaptation of the rayotube for quick and intermittent temperature measurements of equal reliability is under development. The simultaneous use of the rayotube with the commonly employed optical pyrometer made it possible to segregate the precision and accuracy aspects of the latter. The optical pyrometer, when sighted on the free surface of the molten iron, has certain limitations in accuracy due to changing emissivities, and methods are shown for minimizing these errors. H.E.S.

SEPARATE PUBLICATIONS

Active List of Permissible Explosives and Blasting Devices Approved Previous to June 30, 1943. J. E. TIFFANY AND Z. C. GAUGLER. *U. S. Bur. Mines Rept. Investigations*, No. 3736, 23 pp. Free.—This report shows additional brands of permissible explosives on the active permissible list and 22 permissible explosives transferred from the active to the inactive list. The present list contains 180 brand names. R.A.H.

Sampling and Testing Mineral Aggregates, Sands, and Fillers. British Standard Specification No. 812—1943. British Standards Inst., London. Price 3s 6d.—Methods of (1) sieve analysis, with meshes of sieves to be used, (2) measurement of aggregate shape (flatness and elongation indexes), (3) sampling, and (4) determining specific gravity, volume weight, voids, water absorption, attrition, abrasion, crushing strength, stability, chemical composition, and organic impurities are described in detail. Photographs of typical shapes of stones and of two polished etched slags are included. A.B.S.

Test Sieves. Revised British Standard Specification No. 410—1943. British Standards Inst., London.—In the revision of B.S. 410 for Test Sieves no fundamental changes have been made in the series of meshes, but modified tolerances on "average" and maximum apertures have been adopted which are more evenly graded throughout the series. An additional tolerance has been introduced called "intermediate tolerance," and the maximum percentage of apertures that may exceed this intermediate dimension is specified. As even these revised tolerances might permit too great a variation to meet some special requirements, the specification includes a second series of sieves with more stringent tolerances designated "Special Test Sieves." The manner of expressing tolerances on the apertures of medium-mesh sieves has been brought into line with that now adopted for the fine-mesh sieves. Perforated plate sieves of smaller apertures than were formerly standardized have been included in the coarse-sieve series, which has also been extended to include a selected number of larger apertures. Particulars are now given of 3-in. diameter sieves used for wet sieving. An important feature of the revised specification is the comprehensive appendix relating to the method of examining the aperture widths and wire diameters of fine- and medium-mesh sieves by means of a projection apparatus. In another appendix are particulars of other sieve series in common use. A.B.S.

* Obtained from microfilm.

PATENTS

Abrading apparatus. W. L. KEEFER (Pangborn Corp.). U. S. 2,341,559, Feb. 15, 1944 (Sept. 5, 1941).—Apparatus for centrifugally propelling abrasive in a down-blast direction without the use of a control cage comprising a rotor, a plurality of radially arranged propeller blades carried by the rotor extending inwardly short of the axis of the rotor to define a central space, a feed spout for guiding abrasive into the central space, and a feed-spout extension mounted in the central space.

Abrading apparatus. W. L. KEEFER (Pangborn Corp.). U. S. 2,341,560, Feb. 15, 1944 (Sept. 11, 1942).

Abrasive gun. N. J. QUINN. U. S. 2,341,569, Feb. 15, 1944 (Feb. 3, 1943).

Continuous filter. A. H. SCHUTTE. Can. 417,334, Dec. 28, 1943 (Jan. 24, 1940; in U. S. Feb. 25, 1939). G.M.H.

Electric arc furnace. F. W. BROOKE (Swindell-Dressler Corp.). U. S. 2,343,443, March 7, 1944 (Aug. 19, 1941).

Feeder. W. O. BENNING (Pacific Clay Products Co.). U. S. 2,343,521, March 7, 1944 (April 19, 1941).—Means for feeding articles in pairs and folding the members of each pair with their finished faces together comprising a median conveyer belt and a pair of substantially parallel outside conveyer belts between which the median belt is situated.

Gypsum-board drying apparatus. T. P. CAMP (Canadian Gypsum Co., Ltd.). Can. 417,551, Jan. 4, 1944 (June 26, 1939; in U. S. July 22, 1938). G.M.H.

Load-sharing scale and batching apparatus. O. S. CARLISS (Kron Co.). U. S. 2,343,000, Feb. 29, 1944 (Jan. 27, 1940).

Measuring moisture. L. D. BAVER AND B. T. SHAW (Ohio State University Research Foundation). U. S. 2,343,520, March 7, 1944 (June 12, 1940).—The method of determining the moisture content of a substantial body or area of material comprising inserting into the material at selective representative points similar resistance units, each having terminals exposed for the connection of an indicating instrument, permitting the coils to obtain temperature equilibrium with the material, then successively passing current through each of the coils and so choosing the size of the current and the time interval in which the current is applied that the amount of moisture movement away from each coil is negligible, and correlating the readings afforded by the several coils that the moisture contents which the readings signify as an index of the average moisture content of the material.

Method for measurement of moisture content in granular materials. R. L. STEVENS (Moisture Register Co.). U. S. 2,343,340, March 7, 1944 (Oct. 24, 1940).—The method of making a moisture test of granular, powdered, shredded, or other loose or compressible materials that comprises compressing a sample of the material, creating a high-frequency field in the material, and determining the moisture content of the material by its influence on the field while sustaining the compression of the material at a pressure value sufficient that further increases in pressure do not materially influence the result.

Powdered gypsum dispensing mechanism. H. F. HAGEMEYER (Castings Patent Corp.). Can. 417,382. Dec. 28, 1943 (July 14, 1941; in U. S. July 11, 1939). G.M.H.

Kilns, Furnaces, Fuels, and Combustion

Abnormal dissociation in flame gases. A. S. LEAH. *Nature*, **153** [3870] 23–24 (1944).—Experiments were made with a flow calorimeter consisting of a vertical water-jacketed tube fitted with a burner the height of which could be varied at will. Two similar resistance thermometers, one of a plain platinum-rhodium wire and the other of a quartz-coated wire, each 0.0005 in. in diameter, were placed side by side in the gas stream. The products from the flame could be cooled to any extent before passing the wires by raising or lowering the burner. The results of a series of experiments are as follows:

Expt. No.	Distance from the burners to the wires (in.)	Approx. time for gases to reach wires (sec.)	Temperature (°C.) Quartz-coated wire	Plain wire	Difference
1	1.5	0.2	1020	1180	160
2	3.5	0.4	960	1080	120
3	5.5	0.7	870	980	110
4	7.5	0.9	800	870	70
5	9.5	1.2	730	770	40
6	13.5	1.6	570	570	0
7	17.5	2.1	420	420	0

There is a marked difference in the two temperatures, the plain wire consistently giving the higher value. This is due to the phenomenon of abnormal dissociation. The difference in temperatures persists until the gas temperature is reduced to about 500°C., corresponding to the lapse of about $1^1/_2$ sec. after combustion. Thus it is established that the abnormal dissociation can persist in flame gases when they have been subjected to considerable cooling. See "Latent. . .," *Ceram. Abs.*, **20** [11] 269 (1941). G.A.K.

Combustion hazards. ANON. *Steel*, **112** [3] 60–64 (Jan. 18, 1943).—Combustion hazards in heat-treating and other fuel-fired furnaces can be decreased greatly by the use of modern automatic combustion safety equipment. Causes of explosions in ovens and furnaces and methods of preventing them are discussed. Purging is a necessary factor in the prevention of combustion explosions. The most modern safety equipment utilizes the theory that the flame acts as an electric-current conductor, and an electrode extending into the flame acts as the control. Examples of combustion-safeguard instruments are illustrated for the four types of fuels. M.A.S.

Reclaiming sulfur from coke-oven gas. ANON. *Steel*, **114** [6] 143, 179 (Feb. 7, 1944).—A sulfur extraction plant has been set up by the Ford Motor Co., Dearborn, Mich., for the purification of coke-oven gas. The ammonia thylox method is used. It is necessary to remove this hydrogen sulfide because of its destructive corrosive qualities. M.A.S.

Regional metamorphism of coal in southeastern West Virginia. E. T. HECK. *Bull. Amer. Assn. Petroleum Geologists*, **27** [9] 1194–227 (1943).—The general geology and stratigraphy of the coal field of southeastern West Virginia are discussed. The regional change in the fixed carbon content of the Sewell and No. 3 Pocahontas beds is used to measure regional metamorphism of the coal field. Various theories are challenged, and H. concludes that regional variations in the rank of the coal beds is due to variations in the maximum depth of burial, i.e., load metamorphism. It is admitted, however, that if this theory is valid it must apply both horizontally and vertically, i.e., with stratigraphic depths. There are objections to this application, and the theory might therefore be based on insufficient evidence or on coincidence. G.M.H.

Sampling coal shipments. D. R. MITCHELL. *Nat. Engr.*, **48** [2] 92–97 (1944).—M. discusses the problems involving the proper sampling of coal. These include the factors influencing sampling procedure, methods of sampling, and the statistical control by means of which the various analyses are properly interpreted. Coal handling and storage are mentioned. 3 photographs, 9 diagrams, and 4 tables. M.R.

***Waste heat from rotary cement kilns and calcination air.** W. ANSELM. *Zement*, **31** [37/38] 396–99 (1942).—Additional charts and formulas are presented for calcu-

* Obtained from microfilm.

lating the heat reclaimed from rotary kiln exhaust gases. Samples illustrating the method of calculating are given. M.Ho.

Water vapor in flue gases. R. H. PARSONS. *Engineer*, **177** [4595] 89–90 (1944).—Chimney losses are always considered as (*a*) heat carried away by dry gases and (*b*) heat in the water vapor associated with them. P. shows that the percentage of moisture in flue gases may be obtained by means of an apparatus simple enough to be made and used in the smallest plant. A formula is given by which the computation can be made. The weight of moisture in the gases per pound of burned carbon can be computed by a second formula, for which a chart is given, and the heat loss due to the water vapor is thereby obtained. A comparison of the weight of the moisture actually present with the amount to be expected from the nature of the fuel gives an indication of any mixture of steam with the flue gases and enables the consumption of soot blowers and the leakage from fittings to be estimated with substantial accuracy. G.A.K.

SEPARATE PUBLICATIONS

Application of the Rosin-Rammler Law to the "Missing Sizes" in Screened Coal. G. S. SCOTT. *U. S. Bur. Mines Rept. Investigations*, No. 3732, 9 pp. Free.—The Rosin-Rammler law of size distribution is applied in the calculation of "missing sizes" in coal. An analytical method of solution is shown for one illustrative example, and a graphic method is also shown. Data are included for preparing graphs for Rosin-Rammler plots. R.A.H.

Carbonizing Properties and Petrographic Composition of Thick Freeport-Bed Coal from Harmar Mine, Harmarville, Allegheny County, Pa., and the Effect of Blending This Coal with Pocahontas No. 3- and No. 4-Bed Coals. J. D. DAVIS, D. A. REYNOLDS, G. C. SPRUNK, C. R. HOLMES, AND J. T. MCCARTNEY. *U. S. Bur. Mines Tech. Paper*, No. 655, 46 pp. Supt. of Documents, Washington, D. C. Price 10¢.—This paper gives the results of tests by the BM-AGA method. R.A.H.

Geology

Adsorption of phosphate by clays. R. COLEMAN. *Soil Sci. Soc. Amer., Proc.*, **7**, 134–38 (1942).—C. attempts to determine the manner in which phosphorus is held by kaolinitic and montmorillonitic clays. From his studies he concludes that free iron and aluminum are primarily responsible for the adsorption of phosphate. Only a small part is attributed to base exchange. W.R.B.

Bauxite in Tasmania. W. B. WILLIAMS. *Bull. Imperial Inst.*, **41** [3] 196–200 (1943).—The occurrence of bauxite in Tasmania has been established beyond the initial stages of identification, and although the average material is not regarded as high grade, proved and potential resources indicate a substantial volume of ferruginous bauxite commercially suitable for the production of aluminum. Bauxite occurs at Ouse as a lenticular crust over an area of about 220,000 sq. yd. with a thickness up to 19 ft. The calculated volume in the inner area of this deposit is 500,000 tons of an average value per ft. of sample of 41.2% of available alumina and 3.2% of free silica. Bauxite crusts occur in extensive tracts of country in the Campbell Town district. The extent of commercial ore appears patchy, but selective methods and beneficiation may enable quantities of ore to be produced. Deposits of bauxite have been definitely located at Swansea and St. Leonards, but investigations have been limited to the searching of outcrops and prospect shafting to determine ore types and grades. Samples from outcrops at Swansea showed available alumina 35.9 to 42.4% and free silica 1.6 to 6.1%. G.A.K.

Beryllium. D. C. MCLAREN. *Mining Mag.*, **69**, 273–82 (1943).—The only commercial ore is beryl. It occurs in granite pegmatites and is usually a by-product of mining for feldspar, mica, or lithium minerals such as lepidolite, spodumene, or amblygonite. The U. S. mines 100 to 150 tons of beryl annually and imports 2000 tons. Helvite, a beryllium mineral resembling garnet, may be a potentially important source. The beryl is fused with sodium fluosilicate at 650°C., as the first step in the extraction. Most of it goes into beryllium copper, but the oxide is a superrefractory and raw beryl is used in ceramics. W.D.F.

Classification of faults. STUART K. CLARK. *Bull. Amer. Assn. Petroleum Geologists*, **27** [9] 1245–65 (1943).—A classification of faults based on the type of mechanical failure is proposed: (1) normal diagonal shears, (2) reverse diagonal shears, (3) horizontal faults, (4) tension faults, (5) lateral shears, and (6) vertical shears. G.M.H.

Classification of faults. CHESTER R. LONGWELL. *Bull. Amer. Assn. Petroleum Geologists*, **27** [12] 1633–42 (1943).—In challenging Clark's proposed classification (see preceding abstract) L. proposes the following: (1) normal, reverse, and vertical dip-slip faults; (2) right and left strike-slip faults; and (3) right- or left-normal, right- or left-reverse, and right- or left-vertical oblique-slip faults. G.M.H.

Clays as colloidal electrolytes. C. E. MARSHALL AND C. A. KRINBILL. *Jour. Phys. Chem.*, **46**, 1077–90 (1942).—From structural considerations, clays of the montmorillonite and attapulgite groups can strictly be classed as colloidal electrolytes, whereas clays of the mica and kaolin groups lie outside. In general, for the cations Na^+, K^+, and NH_4^+, the ionization of the clay "salts" follows the order kaolinite > montmorillonite > beidellite > illite, whereas the strength of the clay "acids," as judged by their dissociation of hydrogen ions, are in the order montmorillonite > beidellite > illite > kaolinite. R.A.G.

Composition of some chromites of the Western Hemisphere. ROLLIN E. STEVENS. *Amer. Mineralogist*, **29**, 1–34 (1944).—The results are given of 52 complete and 144 partial analyses of purified chromite from deposits in the Western Hemisphere. The analyses show, in general, the grade of chromite at the various localities studied, and the complete analyses are used to interpret isomorphism in chromites. None of the samples had a composition close to $FeO \cdot Cr_2O_3$, the formula usually assigned to chromite. The general formula is $(Mg,Fe)O \cdot (Cr,Al,Fe)_2O_3$. The end members, ferrochromite ($FeO \cdot Cr_2O_3$), magnesiochromite ($MgO \cdot Cr_2O_3$), spinel ($MgO \cdot Al_2O_3$), hercynite ($FeO \cdot Al_2O_3$), magnesioferrite ($MgO \cdot Fe_2O_3$), and magnetite ($FeO \cdot Fe_2O_3$), occupy the corners of a triangular prism of composition. The principal zone of isomorphism ranges from magnesiochromite and spinel to magnetite, leading to the division of chromites into the following types, with the replaceable ions written in order of abundance. (1) aluminian chromite $(Mg,Fe)O \cdot (Cr,Al,Fe)_2O_3$; (2) ferrian chromite $(Mg,Fe)O \cdot (Cr,Fe,Al)_2O_3$; (3) chromian spinel $(Mg,Fe)O \cdot (Al,Cr,Fe)_2O_3$; (4) ferrian spinel $(Mg,Fe)O \cdot (Al,Fe,Cr)_2O_3$; (5) chromian magnetite $(Fe,Mg)O \cdot (Fe,Cr,Al)_2O_3$; and (6) aluminian magnetite $(Fe,Mg)O \cdot (Fe,Al,Cr)_2O_3$. The analyses may be calculated to four end members, but several groups of four end members may be selected to interpret one analysis and no single group suffices for all of the analyses. Metallurgical-grade chromite has at least three parts by weight of chromium to one of iron. Refractory and chemical grades need not be so high. W.D.F.

Determination of apparent density. E. P. PERRY. *Soil Sci. Soc. Amer., Proc.*, **7**, 409–11 (1942).—The apparent density of a soil or clay sample is determined by oven-drying the sample piece, coating it with paraffin, and suspending it in liquids of various densities. W.R.B.

Elimination of sorption-desorption hysteresis in hydrous oxide gels: II. H. B. WEISER, W. O. MILLIGAN, AND W. C. SIMPSON. *Jour. Phys. Chem.*, **46**, 1051–59 (1942).—The results previously given on silica gel have been confirmed and extended with the gels of tantalum pentoxide, stannic oxide, and titanium dioxide. The sorption-desorption hysteresis loop is much reduced or eliminated by hydrolyzing the salts at the boiling point and aging the

sols before coagulating them to gels. With stannic oxide and titanium dioxide, which show crystal growth on aging at 100°C., the effect is probably partly due to this cause. With silica and tantalum pentoxide gels, "amorphous" X-ray and electron-diffraction patterns are shown both with oxides from fresh solutions at 0°C. and from sols aged at 100°C. In terms of Barkas's theory, the elimination of the hysteresis would require that gels from aged sols possess a more elastic structure than those thrown down from freshly formed molecular solutions. For Part I see *Ceram. Abs.*, **23** [1] 25 (1944). R.A.G.

Foundry investigation of bond-clay properties. A. S. NICHOLS, F. W. HINTZE, AND F. L. OVERSTREET. *Trans. Amer. Foundrymen's Assn.*, **50** [4] 1257–300 (1943).—The bonding properties of illite, western montmorillonite, southern montmorillonite, and kaolinite were investigated. The following conclusions were made in regard to castings quality: (1) There was little important difference in the quality of castings produced in sands bonded with the materials tested when the sand is controlled by proper additions and kept within desired specifications, except in the case of the montmorillonites, where the expansion and contraction properties of the western variety and the low deformation property of the southern variety caused defects common to these deficiencies. (2) When additions were discontinued, the castings quality was quickly lowered in the cases of the montmorillonite-type clays, due to their sharp drop in strength. (3) The casting chosen carried sufficient attraction for defects to make the above conclusions applicable to most commonly encountered work in the heavy-castings field. (4) The measured sand properties covered an unusually wide range because of the radical difference in the types of clays used, and yet defects commonly attributed to extremes of permeability, dry strength, or flowability were not consistently found at the limits encountered. (5) Molding practice, gating, and pouring were responsible for more defects than those caused by a deficiency in any clay property. H.E.S.

Government needs quartz crystals. ANON. *Pit & Quarry*, **36** [8] 78 (1944).—Samples of the best crystals are requested to be sent to the Miscellaneous Minerals Division, War Production Board, Temporary "R" Building, Washington, D. C. See "Quartz. . .," *Ceram. Abs.*, **23** [2] 42 (1944). M.R.

Hardness scale. P. GRODZINSKI. *Gemmologist*, **12** [138] 23; [139] 31 (1943).—A short outline of the history of the hardness scale is given. It is shown clearly that (*a*) a clear understanding of the hardness range of minerals existed at least 200 years before Mohs' hardness scale (about 1820), (*b*) hardness testing with scratching points was carried out in a convincing way at least 50 years before Mohs, and (*c*) the science of hardness testing seems to have been adopted by the Germans as their own, whereas scientists of France, Belgium, and Sweden participated in these investigations. A hardness scale similar to that of Mohs was found by G. in A. Rees' Encyclopedia, 1819, Vol. 15. The scale has much in common with Mohs' scale, except that in the first case topaz precedes chrysoberyl. P.G.

Mining a deep limestone deposit in Ohio. GEORGE A. MORRISON. *Amer. Inst. Mining & Met. Engrs. Tech. Pub.*, No. 1622; *Mining Tech.*, **7** [5] 11 pp. (1943).—The Columbia Chemical Division of the Pittsburgh Plate Glass Co. at Barberton, Ohio, decided to supply its limestone requirements by mining a limestone bed on the property instead of shipping it in. The limestone (Delaware, of Devonian age) is 2200 ft. below the surface and 345 ft. thick. It is overlain by 18 ft. of unconsolidated sand and underlain by 200 ft. of gypsum. Two shafts were sunk, one for production and the other for ventilation. A room-and-pillar system was adopted with rooms on 80-ft. centers. The primary crusher is underground. Unusual features are as follows: (1) It is the deepest limestone mine. (2) Shafts are concrete and steel lined throughout. (3) Commercial stone storage is on the ground. (4) There is a glassed-in control room above the trolley bins. (5) The underground crusher is quite large and uses oil pressure lubrication and oil cooling. (6) Skips are loaded automatically, and hoisting is done without a hoistman, which is new at such a depth. (7) Shovels are of unusually large capacity for underground and operate on 2300-volt a.c. (8) Diesel trucks are used underground for all haulage. W.D.F.

Mining and treatment of clay near Mt. Holly Springs, Pa. RICHARD M. FOOSE. *Amer. Inst. Mining & Met. Engrs. Tech. Pub.*, No. 1655; *Mining Tech.*, **8** [1] 4 pp. (1944).—The Philadelphia Clay Co. mines and mills a white clay five miles southwest of Mt. Holly Springs. The clay is the residual weathering product of a sandy schist forming the top of the Cambrian Antietam quartzite. Parts of the clay are quite low in free silica. Underground workings have been used; stopes were made, and the clay fell down by itself and was hauled away. Mining was abandoned, and the clay is now obtained by stripping. The clay is blunged and screened (60-mesh) in closed circuit with the blunger. It is then spread uniformly over 160-mesh silk screens also in closed circuit with the blunger. After it is settled, the water is decanted, and the clay is run into a filter press, dried, and bagged. It is used mainly for white Portland cement and also as a filler in rubber, pigment, and paper. W.D.F.

Nature of colloidal clays as revealed by the electron microscope. B. T. SHAW. *Jour. Phys. Chem.*, **46**, 1032–43 (1942).—Electron micrographs of montmorillonite and kaolinite are shown. The particle-size distribution of montmorillonite depends on the degree of dispersion. In well-dispersed systems it consists of unit crystalline plates. The expanding lattice concept is discussed. In kaolinite the unit plates are more firmly bound together than in montmorillonite. Evidence shows that the base-exchange positions on kaolinite may be located at the plate edges. R.A.G.

Nature and origin of Tasmanian bauxite. D. R. DICKINSON. *Bull. Imperial Inst.*, **41** [3] 200–203 (1943).—Physical characteristics of the known bauxite formations of Tasmania differ widely in various localities, but geological associations are markedly similar and it is believed that the deposits belong to the one epoch and have been derived by similar processes. At Ouse and Campbell Town the bauxite is considered to represent the remnants of early Tertiary volcanic phase, which was succeeded by the deposition of sands and clays with isolated areas of lignite. The normal type of formation at Ouse is a lenticular ore body, often contaminated with clay at the fringes but relatively homogeneous. At Campbell Town the ore of commercial grade occurs as small lenses in formations which, in bulk, carry too much iron and silica to be regarded as bauxite. G.A.K.

Phosphate fixation by clays. C. A. BLACK. *Soil Sci. Soc. Amer., Proc.*, **7**, 123–33 (1942).—B. presents experimental evidence to support the theory that fixation of the PO_4^{---} ion by clays is a base-exchange reaction rather than a reaction with aluminum, iron, or calcium. Results are given for phosphate fixation by kaolinite, Cecil clay, hydrated halloysite, illite, and bentonite. The influence of pH, phosphate concentration, and time of contact are shown. W.R.B.

Radio exploration for buried valleys in Ohio. ROBERT C. HIGGY. *Ohio State Univ. Eng. Expt. Sta. News*, **15** [5] 21–23 (1943).—Field-intensity surveys of radio stations have revealed irregularities clearly traced to preglacial river valleys now filled with glacial drift and not visible on the surface. These rivers are a potential water-supply source. The strength of a ground radio wave is dependent on the absorption of the wave by the ground over which it passes; this absorption is proportionate to the depth of glacial drift over bed rock. Tests with a portable transmitter along Hilliards road, using 2398 kc., showed irregularities in absorption over a hidden valley. Over a larger valley near Newark, standing waves were set up due to reflection and variation in phase of the original and reflected waves. W.D.F.

Stanhope Burn fluorite mine. J. NORMAN WYNNE. *Mining Mag.*, **69**, 265–73 (1943).—The Stanhope Burn fluorite mine in Weardale was being worked on a small scale by hand methods. It was first mined in the 17th century.

A new company has rehabilitated the mine. It is a fissure vein in Carboniferous rocks. The fluorite runs 6 to 8% SiO_2 and 85 to 93% CaF_2. The main uses have been (1) as a flux in steel and brass plants, (2) in ceramics, (3) in glass, and (4) in various chemical industries. Binoculars fitted with fluorite prisms and lenses can be used without eye fatigue far longer than can quartz lenses. W.D.F.

System Fe_2O_3–Mn_2O_3: some comments on the names bixbyite, sitaparite, and partridgeite. BRIAN MASON. *Amer. Mineralogist*, **29**, 66–69 (1944).—At room temperature Mn_2O_3 can hold nearly 30% Fe_2O_3, while at 1000°C. it can hold 60% Fe_2O_3. It dissociates at somewhat higher temperatures. Natural minerals with about 50% of each are of pneumatolitic origin, and those with about 20% Fe_2O_3 are of metamorphic origin. M. recommends calling them all bixbyite; if division is necessary, bixbyite should be used for those of pneumatolitic origin and sitaparite for those of metamorphic origin. Partridgeite, for pure Mn_2O_3, is an unnecessary term. W.D.F.

Two andalusite pegmatites from Riverside County, Calif. ROBERT W. WEBB. *Amer. Mineralogist*, **28**, 581–93 (1943).—One dike is on Coahuila Mountain, and the other is near Winchester. Andalusite, corundum, microcline, and quartz are found in these pegmatites in giant intergrowths. The geological setting is discussed. Thermal metamorphism of aluminous sediments and metamorphic differentiation are thought to account for the features of the two occurrences. See "Some. . .," *Ceram. Abs.*, **21** [7] 153 (1942). W.D.F.

Watchmaker invented the first diamond drill. ANON. *Ind. Diamond Rev.*, **1** [6] 36–37 (1941).—Detailed notes on the invention of the first diamond drill by George Leschot, the watchmaker, are given. His son, Rudolph, was apprenticed as a watchmaker and later became a qualified engineer. In 1862, he was studying the project of a tunnel to Italy and consulted his father about the possibility of perforating hard rock by means of black diamonds. Responding to the demands of his son, Leschot designed the first rock-drilling machine, which was finished in May, 1862. In July, Leschot took out a patent on the subject. Critical notes on core drilling with reference to the discovery of core drills used by the Egyptians (Flinders-Petrie, 1883) are included. P.G.

X-ray diffraction procedure. N. N. HELLMAN, D. G. ALDRICH, AND M. L. JACKSON. *Soil Sci. Soc. Amer., Proc.*, **7**, 194–200 (1942).—A further note on X-ray diffraction procedure for the positive differentiation of montmorillonite from hydrous mica is presented. See *Ceram. Abs.*, **22** [10] 182 (1943). W.R.B.

BOOK

Geology of Kentucky. ARTHUR C. MCFARLAN. Univ. of Kentucky, Lexington, 1943. 531 pp., 158 illustrations, cloth. Price $4.50. Reviewed in *Bull. Amer. Assn. Petroleum Geologists*, **27** [7] 1021 (1943). G.M.H.

PATENTS

Drilling-mud processing. A. D. GARRISON (Texaco Development Corp.). Can. 418,197, Feb. 1, 1944 (June 24, 1940; in U. S. July 1, 1939). G.M.H.

Preparation of drilling muds. C. F. TEICHMANN (Texas Co.). U. S. 2,341,581, Feb. 15, 1944 (Feb. 24, 1937).—A drilling mud comprising clay, water, and lithium trithiotetraphosphate.

Removal of silica from nonmetallic ores by froth flotation. E. J. MAUST AND C. A. HOLLINGSWORTH (American Cyanamid Co.). U. S. 2,343,221, Feb. 29, 1944 (April 29, (1942).—A method of floating silica from a nonmetallic ore which comprises conditioning an ore pulp with a solution of a condensation product of higher fatty acids with polyalkylene polyamines, at temperatures below those at which substantial quantities of imidazolines are formed by ring closure, which has been heated until clarified, and subjecting the conditioned pulp to froth flotation before the clarified reagent has stood in the pulp for a sufficient time to reprecipitate colloidal matter.

Separation of nickel from ores. ALAN KISSOCK. U. S. 2,341,873, Feb. 15, 1944 (Feb. 12, 1943).—A process for the separation of nickel, together with cobalt and copper when associated therewith, from ores containing a relatively high percentage of iron which comprises reduction of the oxides of nickel, cobalt, and copper, but not the oxide of iron, substantially to the metallic state and subjecting the reduced ore to an aqueous solution which contains hypochlorous acid.

Well drilling mud. E. P. PARTRIDGE. Can. 417,332, Dec. 28, 1943 (Aug. 8, 1941; in U. S. Aug. 9, 1940). G.M.H.

Chemistry and Physics

***Approximation functions [for calculating] of the characteristic curves and surface area of ground products.** F. GILLE. *Zement*, **31** [31/32] 331–37 (1942).—A mathematical analysis of the Rosin-Rammler equation for calculating the characteristic curve and total surface area of a cement ground in a ball or vibrating mill is presented. This equation is $y = 100e^{-bx^n}$, where y is the weight per cent of a fraction of which the particle size is equal to or larger than x, b and n are constants depending on the nature of the material and the grinding, and e is the base of natural logarithms. This equation is quite adequate for calculating the characteristic curve of a cement, provided the smallest particle size is disregarded. This formula cannot be used for calculating the total surface area. To calculate the surface area and to consider the smallest particle size, this equation should be modified by substituting a in the place of 100. Thus, it becomes $y = a \cdot e^{-bx^n}$, a being a parameter that differs for each curve. There are instances where a grinding curve cannot be represented by a function of the above type. In such cases 2- and 3-membered functions must be used. M.HO.

Comparison of methods for determining the exchangeable cations and exchange capacity. L. B. GOLDEN, N. GAMMON, AND R. P. THOMAS. *Soil Sci. Soc. Amer., Proc.*, **7**, 154–61 (1942).—Displaceable bases and exchange capacity were determined on ten widely different soils, using normally ammonium acetate, ammonium formate, barium chloride, manganous acetate, manganous chloride, potassium acetate, potassium chloride, ammonium chloride, $N/2$ acetic acid, $N/20$ hydrochloric acid, and $N/5$ cupric acetate. Ammonium acetate was found best for displacement, and potassium or barium acetate was superior in estimating the total exchange capacity. W.R.B.

Differential thermal analysis of clays and shales, a control and prospecting method. R. E. GRIM AND R. A. ROWLAND. *Jour. Amer. Ceram. Soc.*, **27** [3] 65–76 (1944). —6 references, 17 figures. See *Ceram. Abs.*, **22** [6] 107 (1943).

Flow method for determining the number of particles. EDUARD M. GALVEZ LAGUARTA. *Kolloid-Z.*, **101**, 165–67 (1942).—The method consists of determining the number of particles which pass with a uniform velocity through a definite area. The number of particles contained in a given volume is obtained as the product of area, velocity of flow, and time of counting. The area of the optical system can be kept constant. The time of counting, the velocity of flow, and the dilution can be chosen to give the optimum conditions for observation and a high degree of accuracy. Two procedures are open for this method: (1) count the particles in a definite volume flowing at a known velocity, or (2) count a definite number of particles and note the time consumed. The velocity of flow must be kept uniform and constant. For practical reasons the second procedure is preferable. The cross area through which the particles pass is accurately determined with a graduated ocular or other optical method. Flow is induced either by hydrostatic pressure or by impressing an electric field.

* Obtained from microfilm.

The electric field is preferable. Care should be taken to place the electrodes so far apart that no secondary reaction products will be formed. M.Ho.

Fundamental study of clay: V, Nature of water film in plastic clay. F. H. NORTON AND A. L. JOHNSON. *Jour. Amer. Ceram. Soc.*, **27** [3] 77–80 (1944).—10 references, 5 figures. For Part IV see *ibid.*, **25** [12] 336–46 (1942).

Identification of constituents of soil colloids. W. P. KELLEY AND J. B. PAGE. *Soil Sci. Soc. Amer., Proc.*, **7**, 175–81 (1942).—Criteria for identifying soil-colloid constituents are considered. Methods discussed include calculation of molecular ratios, dehydration curves, optical methods, X-ray analysis, electron microscope, and differential thermal method. Important identification characteristics of the following colloids were discussed: hydrous mica, montmorillonite, kaolinite, hydrated halloysite, gibbsite, and commercial permutite. W.R.B.

Industrial production of synthetic rubies and sapphires in U.S.S.R. F. V. SYROMYATNIKOV. *Trudy Vsesoyuz. Nauch.-Issledovatel. Inst. Mineral. Syr'ya*, No. 146, pp. 5–15 (1939); translated in *Gemmologist*, **13** [145] 1–2 (1943).—The industrial importance of synthetic rubies is pointed out. The history of synthetic corundum in the U.S.S.R. since 1928 is given. The most suitable starting material is aluminum oxide powder, which is obtained by roasting ammonium alum. Thermal analyses carried out during the heating (1 hr.) illustrate the various changes. A detailed study was made of the crystallization of the aluminum oxide in the flame. The main defects are occluded gas bubbles; the need to control the supply of oxygen is obvious, but the various devices suggested are not free from faults. Special attention is given to the industrial development. P.G.

Internal structure of silicate minerals that gelatinize with acid. K. J. MURATA. *Amer. Mineralogist*, **28**, 545–62 (1943).—Minerals that gelatinize with acid were arranged according to their internal structure as follows: (1) minerals with silicate radicals of small molecular weight, e.g., orthosilicates, pyrosilicates, and possibly others, and (2) minerals with large continuous silicon-oxygen networks that will disintegrate into small units, e.g., (*a*) disilicates with appreciable ferric iron in the sheets and (*b*) silica-type networks with at least 2 aluminum atoms to 3 silicon atoms. Minerals that separate insoluble silica instead of gelatinizing have large dimensional structures that do not disintegrate under acid attack. These are SiO_3 chains, Si_4O_{11} double chains, Si_2O_5 sheets with little ferric iron, and silica-type networks that contain less than 2 aluminum atoms to 3 silicon atoms. W.D.F.

Membrane electrodes. C. E. MARSHALL. *Soil Sci. Soc. Amer., Proc.*, **7**, 182–86 (1942).—M. discusses the membrane electrode, sensitive to metallic cations, to be used in the direct electrometric determination of calcium, magnesium, potassium, or sodium ions. See "Electrochemical. . .," *Ceram. Abs.*, **21** [11] 247 (1942). W.R.B.

Orientation of diamonds by X-rays. NORA WOOSTER. *Ind. Diamond Rev.*, **3** [26] 1–3 (1943).—The crystallographic axes of the diamond can easily be determined by X rays and suitable apparatus with the help of Bragg's law. An instrument designed to utilize this law is the Wooster-Martin ionization spectrometer which consists of three parts, viz., the slits, the crystal holder, and the ionization chamber which is filled with argon. The X-ray beam reflected from the crystal and picked up by the ionization chamber ionizes the gas contained therein. Since the number of ions produced is proportional to the quantity of X rays absorbed by the gas, the movement of the galvanometer needle not only shows that X rays are being reflected by the crystal but also the quantity. When the position of strongest reflection has been found, the adjustments of the goniometer head are used to bring the plane reflecting the X rays parallel to the plane of the vertical circle. When the positions of two cube faces have thus been found, the position of the crystallographic axis has been established. When rough diamonds show a skin, it is necessary to clean them before looking for the axis. Illustrated. P.G.

Phase relations in the system calcium orthosilicate–orthophosphate. M. A. BREDIG. *Amer. Mineralogist*, **28**, 594–601 (1943).—Two different crystal structures, isotypic with hexagonal α- and orthorhombic β-potassium sulfate, occur in calcium orthosilicate containing small amounts of various additions. This and the fact that γ-Ca_2SiO_4 is isotypic with β-Na_2BeF_4, whose high-temperature form (α) is also isotypic with α-K_2SO_4, leads to the assumption that calcium orthosilicate, above 1420°C., is isodimorphous with potassium sulfate. B. shows how these relations influence the shape of a schematic equilibrium diagram of the system Ca_2SiO_4–$Ca_3(PO_4)_2$. W.D.F.

PATENTS

Barium sulfate decomposition. F. W. DE JAHN. Can. 417,624, Jan. 11, 1944 (Feb. 14, 1941). G.M.H.

Preparation of titanium dioxide. E. I. DU PONT DE NEMOURS & CO. AND C. M. OLSON. Brit. 558,285, Jan. 12, 1944 (April 15, 1942).

Production of sodium and potassium carbonates. R. D. PIKE. U. S. 2,343,081, Feb. 29, 1944 (Feb. 26, 1942).—Method of producing potassium carbonate from wyomingite and crude sodium carbonate.

Purification of crude zirconium compounds or ores. C. E. EVERY (Titanium Alloy Mfg. Co.). Brit. 559,117, Feb. 16, 1944 (July 3, 1942).

General

Brazed ends make wire rope safer. F. L. SPANGLER. *Safety Eng.*, **85** [5] 29 (1943).—S. describes a simple method of eliminating the hazard of sharp exposed rope ends by brazing the end of the rope with a bronze welding rod and running the bronze back 1 or 2 in. from the end. Since preforming removes all unbalanced stresses in the rope wires and strands, preformed rope can be brazed without using a seizing. For rope not preformed, two to three seizings should be applied. 1 photograph. M.R.

Ceramic industry still branching out. G. C. KEITH. *Clay Products News*, **17** [1] 3 (1944).—K. reports progress in the ceramic industry in Canada during 1943. A new steatite porcelain plant is in operation. A plant has been built and equipped to refine a high-grade china clay for the paper, rubber, and ceramic industries. Bentonite deposits have been operated for use as foundry sand, in oil drilling, and as a bleaching clay for oil refining. Dead-burned magnesium for the manufacture of refractories is being produced from brucite. G.A.K.

Conveying and elevating plant at cement works. G. E. A. *Mech. Handling*, **31** [2] 73–75, 77 (1944).—A. presents a detailed description of a conveying and elevating plant installed at various works of the Associated Portland Cement Manufacturers, Ltd., by Redler Conveyors, Ltd., of Dudbridge Works, Stroud, England. 7 photographs. M.R.

Core sand reclamation at elevated temperatures. D. L. LONGEUVILLE AND O. JAY MYERS. *Trans. Amer. Foundrymen's Assn.*, **51** [1] 198–206 (1943).—Core sands are reclaimed by burning out the binding materials, thereby restoring the sand to its original unbonded state. From comparative tests of new and reclaimed sand mixtures the following conclusions are drawn as to the properties of the reclaimed sand: (1) lower tensile and transverse strength, (2) lower permeability, and (3) higher green compression strength. These variations probably result from the fine material in the sand, rather than from any deleterious effects of the reclamation process. H.E.S.

Diamond dust is not injurious to the lungs. ANON. *Ind. Diamond Rev.*, **3** [36] 64 (1943).—The popular belief that diamond dust is poisonous is proved to be untrue. Dust is dangerous only if it is allowed to float in the air and thus be inhaled by the workers. Diamond dust is always bound with oil and in no instance is used loosely in

the machines, laps, or scaifes (diamond dust with Al_2O_3, in contrast to SiO_2, is in itself chemically inert). A short historical sketch shows why diamond dust was always thought to be poisonous. Bibliography. P.G.

Dust separation. ANON. *Safety Eng.*, **85** [3] 44 (1943).—Separation and removal of dust from the air are discussed. Dust can present both a health hazard and a fire hazard at the same time. The collection of dust may bring about a fire hazard. The use of an inert gas which reduces the oxygen content of dust-laden air may eliminate such danger. Other precautionary methods are described. M.R.

Exposure to manganese. ANON. *Safety Eng.*, **85** [5] 46 (1943).—A special committee of health experts in the government and in industry has developed a standard establishing the allowable concentration of manganese. This sets 60 mgm. of manganese per 10 cc. of air as the maximum allowable concentration of manganese dust or fumes in any place where employees are working regularly. Standards are being formulated for other dusts, gases, and substances which are hazardous to workers' health. M.R.

Females are the practical sex. MARY DAVIS GILLIES. *Finish*, **1** [1] 32–34, 36, 58 (1944).—Refrigerators, ovens, cabinets, counter surfaces, and wall materials for postwar kitchens are discussed on the basis of a widely circulated questionnaire. A particularly strong interest in plastics was noted. The all-glass oven idea was universally popular, and glass or tile walls received support. V.D.F.

Fires and explosion. Hazards of flammable gases, vapors, liquids, and dusts. W. J. BURKE. *Safety Eng.*, **85** [3] 27–31, 34 (1943).—B. discusses the safeguarding of workers' lives and the prevention of injury from industrial fires and explosions. Ninety per cent of all fires and explosions are due to carelessness encouraged by poor industrial housekeeping. Careful housekeeping is one of the chief preventive measures, while others are proper ventilation, prohibition of smoking in hazardous locations, proper lighting equipment, adequate fire-fighting equipment, dissipation of dangerous static charges, and suitable instruction of workers. M.R.

Foundry dust. ANON. *Safety Eng.*, **82** [6] 41–42 (1941); **83** [1] 40; [2] 40, 42 (1942).—More than 50% of the silicosis claims allowed by the Ohio Industrial Commission in its first three years of experience originated in foundries. Silica dust is stirred into the foundry atmosphere by nearly every foundry operation. Unloading sand, tempering sand, molding, core-making, shaking out and cleaning castings, and the use of facing compounds contribute to the hazard; the last-named operation is one of the most dangerous. Dust removal by means of an exhaust system, ample ventilation, good housekeeping, and faithful use of individual respiratory protective equipment are suggested as possible means of controlling the dust hazard in foundries. 3 photographs. M.R.

How to change the properties of sand: I. N. J. DUNBECK. *Amer. Foundryman*, **6** [1] 9–12 (1944).—Economy of changing the properties of sand in the foundry to suit the work at hand is discussed. Properties are affected by mixing of the sand, addition of water, amount of ramming, amount of clay, type of clay, amount of auxiliary binders, types of chemical additions, types of sprays, and extent of skin and oven drying. Green, dry, and hot strengths of the sand are considered. **II.** *Ibid.*, [2] 8–12.—D. discusses the various types of sands and clays which are used to gain the desired casting results. Such properties of the sand as permeability, flowability, deformation and resilience, expansion and contraction, sintering point, collapsibility, lumpy sand at shakeout, amount of tempering water required, durability, and drying out of synthetic sand are considered. See "Drying. . ., *Ceram. Abs.*, **22** [5] 90 (1943). M.A.S.

How to design exhaust hoods: IV, Criteria for determining hood effectiveness. J. M. DALLAVALLE. *Heating & Ventilating*, **40** [6] 91–95 (1943).—D. outlines the basic principles of test criteria, both by threshold limits and the provision of air-volume requirements. Tables provide data on probable safe limits of exposure, physical properties of common gases and vapors, minimum air velocities required to capture certain industrial dusts and vapors, and cu. ft. per min. of air handled through average grinding-wheel hoods. 4 tables and 1 photograph. **V, Hoods for dust control: total enclosures and screening.** *Ibid.*, [7] 65–69.—These hoods are classified broadly into two classes: (1) those which enclose a dusty operation completely and (2) those which act as partial barriers. The operations covered are barrelling and bagging, flat-deck screening, cylindrical screening, asbestos opening, and fur blowing. 2 tables, 4 diagrams, and 5 references. **VI, Hoods for dust control: partial enclosures for grinding.** *Ibid.*, [8] 63–66 (1943).—Wherever operations require constant attention on the part of the worker, partially enclosed hoods are used. D. discusses such operations as (1) stationary grinding, (2) swing grinding, (3) miscellaneous grinding, (4) polishing and buffing, and (5) grinding of magnesium. 5 tables, 7 diagrams, and 2 references. **VIII, Hoods for control of fumes, mists, vapors, and gases.** *Ibid.*, [10] 71–74.—Hoods are separated into three broad groups: (1) hoods placed over tanks; (2) canopy-type hoods for removal of smoke, gases, and fumes from heated sources; (3) boothlike structures similar to those used for spray painting. 7 diagrams. **XII, Examples of calculations required in designing hoods.** *Ibid.*, **41** [2] 52–54 (1944).—In this concluding article, D. discusses methods of applying the information given previously. Five examples deal with types of conditions which have not been described earlier. Necessary procedures are given. 3 diagrams. For Parts VII and IX–XI see *Ceram. Abs.*, **23** [3] 61 (1944). M.R.

Metallic poisons. J. M. MCDONALD. *Safety Eng.*, **85** [1] 33–36; [2] 41–43 (1943).—In addition to a general discussion of industrial remedies, M. gives data pertaining to many metallic dusts and fumes. Included are lead, mercury, cadmium, manganese, antimony, zinc, arsenic, chromium, thallium, selenium, phosphorus, and radium. 3 pohotgraphs. M.R.

Powder metallurgy. W. D. JONES. *Mech. World & Eng. Record*, **113** [2932] 269–72 (1943).—Powder metallurgy, the art of making metallic articles or masses by molding powdered metals, is described in detail. Powder metallurgy enables the hardness of hard-metal particles to combine with the toughness of the bonding metal to produce a tool possessing the optimum qualities of both. Two powders are mixed in the desired proportions and then sintered, in the case of tungsten carbide at 800°; it is then cut and finally sintered at 1400° to 1500°C. Examples of contact materials are given. The iron parts used are more or less nonporous. Under favorable circumstances powder metallurgy permits either a saving in labor or a transfer from skilled to semiskilled labor, and also either a saving of raw material (by reducing losses) or a transfer from virgin metals to the practical use of secondary metals. P.G.

Principles of melting malleable iron. H. A. SCHWARTZ. *Trans. Amer. Foundrymen's Assn.*, **51** [2] 261–71 (1943).—S. discusses, on a semipopular basis, the principles that limit the temperature obtainable in a furnace. He gives some of the principles underlying the transfer of heat to the molten metal and discusses the effect of furnace-gas compositions on the melt. H.E.S.

Progress report on investigation of effect of high temperatures on steel sands: III, Effect of ramming. J. R. YOUNG. *Trans. Amer. Foundrymen's Assn.*, **50** [4] 977–94 (1943).—The results of a sand research carried out at Cornell University are summarized. The tests were made under single-variable conditions. Only two simple sand mixtures were used, but the following conclusions were drawn: (1) Total ramming energy appears to be a more reliable index of degree of ramming than is green apparent density. (2) With increase in total ramming energy (and green apparent density), both green and dry compression increase and permeability decreases. (3) The same general trends can be indicated by the use of either $1^1/_4$- x 2- or 2- x 2-in. specimens, but the effect of ramming on both specimen sizes is not the same. (4) For the mixtures tested, increase in ramming intensity seems to lower the temperature of peak hot strength. (5) For the mixtures tested, the temperature of peak hot strength is apparently

dependent to some extent on the percentage of bond in the sand. Maximum hot strength is reached at higher temperatures for mixtures of lower percentage of bond. (6) Hot strength varies with moisture and percentage of bond in much the same manner as dry compression varies with moisture and percentage of bond. H.E.S.

Review of iron and steel literature. E. H. McClelland. *Blast Furnace & Steel Plant*, **32** [1] 109–12 (1944).—Annual review. B.L.

Rodgers family in the brick business. Anon. *Bull. Amer. Ceram. Soc.*, **23** [3] 99–103 (1944).—5 photos.

Sand control program in a mechanized malleable foundry. D. F. Sawtelle. *Trans. Amer. Foundrymen's Assn.*, **50** [3] 830–44 (1943).—S. presents a further report of progress in sand control in an old malleable foundry which modernized its technique by the installation of a duplex melting system and the necessary mechanical equipment for continuous melting, sand preparation, molding, and pouring. H.E.S.

Saving sheaves. F. L. Spangler. *Safety Eng.*, **85** [2] 11–12 (1943).—Two methods of building up worn sheaves and cable-drum grooves, arc welding and metal spraying, are described. 3 photographs. M.R.

Sea coal and fuel oil in molding sand. Elmer C. Zirzow. *Trans. Amer. Foundrymen's Assn.*, **50** [3] 878–94 (1943).—While sea coal has been used in foundry sand for a long time, the use of fuel oil is relatively a new development. Z. first discusses sea coal, giving the theories on its action in a mold upon the application of heat, points that should be taken into consideration in the selection of sea coal for use, the proper constituents of sea coal, and methods of adding it to both floor heaps and system sands. Of considerable importance are the factors determining the amount of sea coal in foundry sands. Z. also discusses the effect of this material on the properties of sand and the defects caused by the improper use of sea coal. He points out that while the use of fuel oil in foundry sands is a fairly new development, its use with sea coal was known 10 years ago. Methods of adding fuel oil, typical sand mixtures, their uses, and the effect of fuel oil on the properties of sand are explained. Of particular interest are the savings effected by the use of fuel oil in conjunction with sea coal in iron-foundry sands. H.E.S.

Steel-mill boiler units use supplementary fuels: I. M. H. Kuhner. *Steel*, **114** [3] 96–100, 123 (Jan. 17, 1944). —Design requirements for high-capacity steam generating plants firing blast-furnace gas in combination with pulverized coal must be understood in terms of low rate of heat release. K. deals with boiler, furnace, and superheater design and the control of combustion air. **II.** *Ibid.*, [4] 62–66 (Jan. 24, 1944).—Quick-cleaning burners for blast-furnace gas and a recently designed unit for handling four types of fuel, either independently or in combination, are discussed. Details of the successful performance of steel-mill boilers fired with blast-furnace gas in combination with other fuels are summarized. M.A.S.

Temperature limits. Factors determining values for oil-immersed transformers. C. H. Pike. *Elec. Rev.*, **134** [3450] 9–11 (1944).—P. discusses the effect of higher temperatures on the insulation of oil-immersed transformers. Maintenance of insulation at high sustained temperatures will result in its rapid deterioration. 2 tables, 5 references. M.R.

Temperatures developed in sand cores during the casting of magnesium alloys. M. V. Chamberlin and A. T. Peters. *Trans. Amer. Foundrymen's Assn.*, **51** [1] 155–79 (1943).—The authors present the need for the development of a core binder to overcome the difficulties now experienced in casting magnesium alloys because of inadequate core collapsibility. The use of pneumatic tools in core removal resulted in breakage of many thin-section castings. Core collapsibility was found to be influenced by (1) temperature to which the core may be heated during the interval between pouring and knockout, (2) length of time that the core remains at an elevated temperature, (3) atmosphere prevailing in the core during the period at which it is at an elevated temperature, and (4) composition of the core. Core-temperature tests were made during the casting of magnesium alloys. Tests were also made for the purpose of comparison during the casting of aluminum alloys, bronze, and gray iron. The heat content, by volume, of aluminum alloys at 1400°F., bronze at 2100°F., and gray iron at 2500°F. is 70, 190, and 290%, respectively, greater than that of magnesium alloys at a casting temperature at 1400°F. Temperatures developed in the cores of the magnesium alloy castings were found to be appreciably lower than those developed in the casting of aluminum, bronze, and gray iron. The length of time the core remains at an elevated temperature was also found to be much shorter in the case of magnesium. The need for a core binder which will break down at the low temperatures attained by cores and in the short time they remain at that temperature is stressed. H.E.S.

Thermal process of core-sand reclamation. W. L. Hartley. *Trans. Amer. Foundrymen's Assn.*, **51** [1] 207–12 (1943).—A continuous method of reclaiming core sand consists of passing the sand through a high-temperature rotary kiln. A reclamation cost of $1.44 per ton of sand is given. In addition to the economies of this process, operating results show improved sand control as a result of the uniform products obtained. Screen analysis of the reclaimed sand can be controlled within narrow limits by regulation of exhaust velocities from the cooler. H.E.S.

Transformer protection. Restricted-zone earth-leakage system. H. E. Forrest. *Elec. Rev.*, **134** [3451] 47–49 (1944).—F. describes the "restricted-zone ground-leakage" protection system which may be applied to the higher- or lower-voltage side of the transformer. 3 diagrams. M.R.

Wire-rope standards simplified. Anon. *Safety Eng.*, 85 [6] 34 (1943).—The Division of Simplified Practice of the National Bureau of Standards has issued a recommendation for wire rope. This simplification program is the result of a long study by the wire rope industry. The varieties are reduced from 973 to 643. M.R.

THE BULLETIN SECTION

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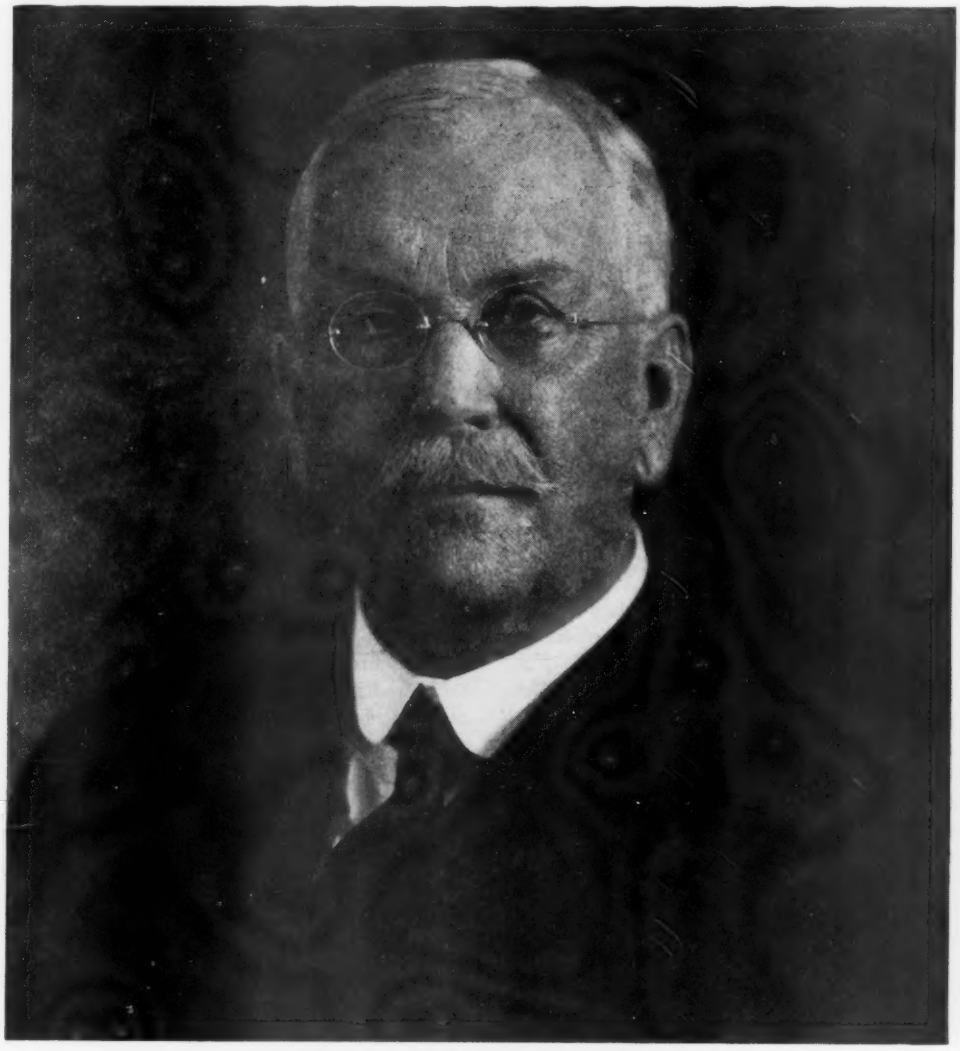


JOHN ALEXANDER CAMPBELL

John Alexander Campbell was born January 31, 1856, in Shushan, Washington County, New York, the son of Peter and Mary J. Campbell. He was of Scotch descent. His paternal grandfather was the Reverend Peter Campbell, who came from Scotland, and his grandmother was Elizabeth Law Campbell, who was born in this country.

On his mother's side, Mr. Campbell's grandparents were Alexander McIntosh and Susannah Montgomery McIntosh. The latter's father was John Montgomery, an American Revolutionary soldier.

Graduated from Collegiate Institute, New York City, in 1873, Mr. Campbell the same year matriculated at

Princeton University, Princeton, New Jersey. He was graduated from there with an A.B. degree in 1877, a class which included some of Nassau's most famous sons.

At Princeton, Mr. Campbell took an active part in athletics and for two years was first baseman on the varsity baseball team. He also was rated a crack pitcher and was a rowing enthusiast, having been a member of the '77 class crew (Princeton's First) that won honors at Saratoga in June, 1874.

Never in all the years that followed his graduation from the university did Mr. Campbell lose his interest in Old Nassau. Year after year he returned for alumni festivities each June. He also regularly attended the baseball and football games at Princeton. His alma mater conferred an honorary master of arts degree upon him in 1907.

He was the first president of the class of '77 and was re-elected each year by his classmates. As an expression of their appreciation of his devotion to the university and the class, they gave him a handsome silver cup on the occasion of the fifty-fifth reunion in June, 1932. Princeton's Campbell Hall was named after him by his associates of '77 exemplifying the esteem in which he was held.

After leaving Princeton, Mr. Campbell went to New York City to engage in the pottery importing business. He remained there until 1879, when he went to Trenton to become associated with the International Pottery. On October 30 of the same year, he married Fannie Cleveland of Shushan, New York.

In the International Pottery, he was associated with his former classmate at Princeton, the late William Burgess, with whom he had engaged in pottery jobbing in New York. The pair turned their attention to Trenton as a prospective business field when they found it difficult to obtain regular shipment of goods from England. Trenton at that time was known as "the Staffordshire of America."

During a conversation with John Moses, owner of the International Pottery, the latter offered to sell a half interest in the plant to the two young men. The offer was accepted, and later the youthful partners purchased the remainder of the business from English holders.

Mr. Campbell became treasurer of International, retaining that position until 1906, when he was made general manager of the Trenton Potteries Company.

Under Mr. Campbell's leadership, Trenton Potteries developed into one of the most important pottery companies in the country and absorbed several smaller Trenton plants. He was elevated to head of the firm in 1910. In 1924, the Crane Company of Chicago purchased control of the Trenton company and its subsidiaries, but Mr. Campbell remained as president.

The Trenton Banking Company, Trenton's oldest financial institution, elected Mr. Campbell a director in 1897 and three years later made him vice-president, a newly created post. From 1904 to 1927, Mr. Campbell was president of the bank, resigning in the latter year to be relieved of the responsibility of the office.

The late William E. Green, then vice-president, succeeded to the presidency and Mr. Campbell became chairman of the board of directors. In 1930, however, when Mr. Green died, Mr. Campbell was re-elected bank president, retaining at the same time the board chairmanship. On January 9, 1935, Caleb S. Green was named president and Mr. Campbell continued as board chairman.

Mr. Campbell also was for many years a director and vice-president of the Trenton Savings Fund Society.

During his long, busy, and useful life, Mr. Campbell served on the boards of many companies. He was a director of the Prudential Insurance Company and president of the United New Jersey Railroad & Canal Company, the Delaware & Bound Brook Railroad Company, and the East Trenton Railroad Company.

One of the original members of the commission for freeing Delaware River bridges of tolls, Mr. Campbell served eight years as president of the commission. In 1927, he was one of three New Jersey commissioners chosen to administer provisions of the tri-State water treaty. He also served on New Jersey's banking advisory board.

Mr. Campbell was not only a successful Trenton manufacturer, banker, and businessman, but he also gave almost unlimited time to community service. In the more than half a century he lived in Trenton, he was an outstanding member of many civic committees and organizations. In his younger days, he devotedly served the cause of public education and for nine years was treasurer of the Trenton Board of Education. As a member of the school board he was influential in developing the school system and enlarging educational opportunities.

In 1910, Mr. Campbell was appointed to the board of trustees of the School of Industrial Arts, and for many years he served as president. When the trustees of the Trenton Public Library were appointed in 1900, Mr. Campbell was made a member of the board. He served as library treasurer until 1910, when he succeeded the late Ferdinand W. Roebling, Sr., as president.

For fifteen years he was president of the New Jersey State Board of Tenement House Supervision. He was interested in the Y.M.C.A. and served on its board and at one time served as its president. He also was a loyal supporter of the Boy Scout movement.

Early in the days of the World War, Mr. Campbell began giving of his time and energy to finance Red Cross and relief drives, and later, when the United States entered the conflict, he lent his executive ability in the prosecution of the war.

He served as a member of the New Jersey Draft Exemption Board for the Third District and was treasurer of the Trenton War Emergency Committee.

When, in response to public sentiment, former Mayor Frederick W. Donnelly appointed a committee to plan an appropriate war memorial, he named Mr. Campbell general chairman. He served in that capacity during the arduous days of a public campaign to raise $400,000 by popular subscription to be used with a similar amount of municipal and county funds to erect the handsome War Memorial Building in Stacy Park, on land purchased by the State.

In May of 1938 he declined re-election as chairman of the Memorial Building Commission, after guiding supervision of the memorial since its erection ten years ago.

At the time he left college, Mr. Campbell said an uncle

advised him to join a young church and grow up with it. He became a member of the Prospect Street Church, located near his home, more than half a century ago, and found time from his many other interests for continuous service to the church during the years.

After more than fifty years as a member of the church session and longer than a quarter of a century as president of the board of trustees, he submitted his resignation as an officer of the church in May, 1938, a month before his death at the age of eighty-two.*

* See *Bull. Amer. Ceram. Soc.*, **17** [8] 339–40 (1938).

Mr. Campbell's years of civic service to the community were recognized publicly in 1927 when he was awarded the *Trenton Times'* Civic Cup. The Capitol Theatre was thronged with his friends and admirers to witness presentation of the honor.

Politically, Mr. Campbell was a Republican. His club connections included the New Jersey and Trenton Historical Societies, the Trenton Country Club, the Carteret Club, the Princeton Club of New York, and the Nassau Club.

This sketch of Mr. Campbell was provided by the Trenton Times Newspapers, Trenton, New Jersey.

THE 1944 PRESIDENTIAL ADDRESS*

By Cecil E. Bales

This is our Forty-Sixth Annual Meeting, and we find ourselves in the midst of a multifront war. Due to the ingenuity and resourcefulness of American engineers and technologists, we have been able to develop guns, tanks, planes, and other armament materials which are far superior to those of our enemies, and the day of victory is dawning for the Allied Nations on the European continent. After that, we have another major war to fight in the Pacific, but that one, too, will end in complete victory for us, even though it may be hard and long and bloody.

Ceramic engineers, ceramic manufacturers, and The American Ceramic Society have all had a vital role in the war for production because without high-grade refractories, special porcelains, and the wonderful developments in glass and other ceramic products our armed forces would not have made such excellent progress on the war fronts. You may all be proud of the extra work you have done and of the production records you have broken. You may also be proud of the fact that many of your war developments will have great postwar usefulness.

Naturally, your Society has been affected by this war of destruction. Some of our normal activities had to be curtailed, and there was a serious loss in foreign memberships and subscriptions. However, I am glad to report to you that The Society is in excellent shape financially, income from advertising has increased, and there has been a substantial growth in Corporation memberships.

At this point, I should like to express my appreciation to the Membership Committee under the chairmanship of Ralston Russell, Jr. The members of this Committee have been very active, and they have outlined plans for doubling our membership within the next few years. It can be done, and I ask you in all sincerity to give this Committee your wholehearted cooperation.

It is regrettable that our Student Branches and some of our Local Sections have had to curtail their activities during this war period and the outlook for Student Branches will not be good until the war is definitely won. However, from my visits with the various Local Sections, I am convinced that they have a wonderful opportunity to carry on the traditions of The Society, to create more interest among their members, and to make it possible for more men and women to join this Society. The Local Sections are invaluable to those members who are unable, for one reason or another, to attend our Annual Meetings. It is a real pleasure to tell you that one new Local Section has been organized during the year—the Up-State New York Section.

A year ago, ceramic engineers and technologists were receiving practically no consideration from their draft boards. Thanks to the activities of your Public Relations Committee under the chairmanship of V. V. Kelsey, these men are now listed in all the Occupational Bulletins issued by the Selective Service System and other governmental agencies, and those men in essential industries have been receiving deferments. This has been an excellent Committee, and it now has plans under way to advertise the word ceramics and to show the importance of ceramic products in the nation's economy.

The Special Committee on Associate Secretary under the chairmanship of John D. Sullivan has been very active; they had a most difficult assignment but have conducted their affairs in an admirable manner. Nearly all our Standing Committees have been active, and we owe them a vote of thanks for carrying on under difficult conditions.

This is not a static Society. As a dynamic, democratic organization, it is the world's leader in the promotion of ceramic science and education. Many of the great developments in ceramic industry can be traced back to the stimulus given to the original ideas by committees within this organization. It is reasonable to assume that The Society will continue its leadership during the difficult postwar period, but such leadership carries great responsibility, many complex problems will present themselves, and we must have a program worked out in advance in order to handle them properly.

What will the Society face when the war is ended? Will there be a terrific postwar depression or will there be a period of unprecedented prosperity? I am neither an astrologer nor a prophet, but my guess is that we will have neither. There is really no foundation for a severe depression. Most people are out of debt, many corporations have carried on programs of debt retirement during recent years, the banks are swamped with unprofitable dollars,

* Presented at the Forty-Sixth Annual Meeting, The American Ceramic Society, Pittsburgh, Pa., April 2, 1944. Received March 11, 1944.

there is an excellent relation between the return on securities and their market values, and the individuals of the nation are on a highly liquid financial basis.

Such a condition could easily bring about a runaway, postwar boom, but this is unlikely for several reasons. It has already been announced that the prices of automobiles, mechanical refrigerators, washing machines, radios, electric irons, etc., will be somewhat higher than they were during the prewar period. Many people with War Savings Bonds and bank accounts will remember the severe depression of the '30's, and will use considerable caution and judgment in spending their money. They will wonder about taxes, there will be psychological fear of unemployment, the feeling of insecurity, which has already begun to make itself felt even in the midst of the war-boom period. People who are afraid of losing their jobs make poor customers. Postwar political and social issues are likely to be both vital and violent. Will our political leaders be able to protect our national interests in international negotiations? What about our prospective federal debt of approximately three hundred billion dollars, the service on which may be six billion dollars a year?

It is reasonable to believe that business will be maintained on a fairly high level, either naturally or by governmental stimulation. We will have high wages, high prices, and high taxes for several years to come. Corporate profits, however, may be very meager. Competition between products and competition between members of the same industry may be intensely keen.

Whatever affects business will naturally affect The American Ceramic Society. Several branches of ceramic industry have been severely curtailed during the war, but with an almost assured large volume of private home construction, foreign rehabilitation needs, federal and local construction projects, the structural clay products industry may expect several years of sustained high-level operation. The porcelain enamel and whiteware industries should have an extended period of prosperity. The flat-glass industry should have boom conditions for quite some time, and although the glass-container industry will probably feel the competition of metal containers, they should be able to consolidate their wartime gains and continue to enjoy full-time operation.

The refractories industry has been of vital importance to the nation during the war period, and it has carried out its responsibility in a splendid manner. Now that the war-plant construction program has been completed, there has been a substantial decline in the demand for refractories. However, the outlook for the postwar period is favorable due to the fact that many furnaces will have to be rebuilt and there will be a tremendous amount of repair and maintenance work.

Even though these predictions come true, all manufacturers of ceramic products will realize that high-level operation cannot continue indefinitely. There will come a day when things will settle down to old-time "normalcy," whatever that may be. In order to maintain their position, manufacturers of all types of ceramic products will carry out extended programs of research and development. Old established products will be improved in workmanship and quality and many new products will be developed. This will mean a greater demand for ceramic engineers and technologists and a greater demand for service from The American Ceramic Society.

I am confident The Society can, and will, assume this greater responsibility. In establishing a program for service to industry, The Society should have more members, especially those men engaged in the production of ceramic products. In order to interest those men in the work of The Society, we should have more discussions and publish more papers on practical operating problems. Those who sell ceramic products should also be members of The Society.

We should continue and enlarge on our cooperation to the universities in developing stronger ceramic curricula and stronger Student Branches and encouraging fundamental research. We have a great responsibility to those members who are unable to attend the Annual Meetings. Their interest can be maintained by organizing more Local Sections and working diligently with those Sections we now have.

A concerted effort should be made to secure more advertising, and every possible assistance should be given to our advertisers. They are very important in the affairs of The Society.

Yes, The American Ceramic Society has been, and will continue to be, of great service to industry, to its members, and to the nation. It will continue to grow in power and prestige, and the rate of growth will depend on what each individual member is willing to do.

I have enjoyed working for you during the past year, and I now want to express my deep appreciation to Ross C. Purdy and the office personnel for their complete cooperation and for the magnificent manner in which they have conducted the affairs of The Society.

IRONTON FIRE BRICK COMPANY
IRONTON, OHIO

EDWIN HENRY FRITZ

President of The American Ceramic Society for 1944–1945

Edwin Henry Fritz was born March 9, 1895, in Toledo, Ohio. Moving to Dubuque, Iowa, shortly thereafter, he was introduced early to the proposition of earning money and began to sell and deliver papers when he was ten years old. From then until he finished high school he did various jobs after school hours. He moved back to Toledo when he was fifteen and finished his high-school education there.

After a year out of high school, working as a draftsman at the Toledo Bridge and Crane Company, he continued his education at the Ohio State University, Columbus, Ohio. It was necessary for him to finance the greater part of his college education and consequently during college he did various jobs, such as working in laboratories and playing in dance orchestras. With those earnings, together with those of summer vacations, he was able to complete his college education without interruption.

After receiving the Bachelor of Ceramic Engineering degree in June, 1917, he worked in the engineering department of the American Blower Co., Detroit, Mich., until

October of the same year, at which time he entered the employ of the Westinghouse Electric & Mfg. Co., Derry, Pa. Here he was engaged successively as assistant ceramic engineer, 1917–1919; ceramic engineer, 1919–1927; assistant works manager, 1927–1930; manager, Engineering Department, 1930–1934; and manager, Porcelain Division, 1934–1942. In April, 1942, he was appointed plant manager of the Stupakoff Ceramic & Mfg. Co., Latrobe, Pa., and in October, 1943, was elected vice-president of that Company in charge of all manufacturing activities.

He received the professional ceramic engineering degree from the Ohio State University in 1936.

Society Activities

Although Mr. Fritz is a member of numerous technical societies, his active work has been confined entirely to The American Ceramic Society, to which he has belonged since 1917. He was elected to the Fellowship in 1931.

Affiliated with the White Wares Division, he has served successively as chairman, Rules Committee, 1925–1926; member, Nominating Committee, 1928; Secretary, 1929–1931; Chairman, 1931–1932; Management Committee representative, 1934–1935; member, Nominating Committee A, 1935–1936; member, Education Committee, 1936–1937; Trustee, 1938–1941; and member, Advisory Committee. As a member of the Education Committee he compiled with H. E. White and E. E. Marbaker a valuable report containing data on ceramic education which was published in the March, 1937, *Bulletin*, pp. 116–20.

He also served on the Society Rules Committee in 1925–1926 and as the engineering member on the Committee on Education from 1937 to 1942. He has been vice-president of The Society this past year.

A member of the Organizing Committee of The Institute of Ceramic Engineers, he served as president of this class in 1941–1942.

Civic Activities

Mr. Fritz has been director of the Latrobe, Pa., Hospital since 1935 and has been active in the Red Cross and other charitable organizations in his community. He is also a member of the Office of Civilian Defense staff.

He is a member of the Latrobe Country Club and the Latrobe Masonic Order.

Publications

(1) "Study of Draft Movements in Flues," *Jour. Amer. Ceram. Soc.*, **1** [5] 294–312 (1918).

(2) (With G. I. Gilchrist) "Modern Production of (Porcelain) Suspension Insulators," *Jour. Amer. Inst. Elec. Engrs.*, **40,** 470–79 (1921).

(3) "American Clays as Compared to English Clays in Whiteware Bodies," *Jour. Amer. Ceram. Soc.*, **8** [4] 253–56 (1925).

(4) (With A. L. Donnenwirth) "Some Observations in Casting of Heavy Electrical Porcelains," *ibid.*, [9] 547–51.

(5) "Some Successful Cone 10 Sagger Bodies," *ibid.*, **9** [9] 606–12 (1926).

(6) (With H. M. Kraner) "Study of Some Factory Processes," *ibid.*, **10** [5] 357–66 (1927); reprinted in *Ceram. Ind.*, **8** [5] 540–43 (1927).

(7) (With H. M. Kraner) "Rate of Oxidation of Porcelain and Ball Clays," *ibid.*, **12** [1] 1–13 (1929).

(8) "Tunnel-Kiln Installation for Porcelain Insulators," *ibid.*, [11] 711–15.

(9) "Quality Control System in a Porcelain Insulator Plant," *Bull. Amer. Ceram. Soc.*, **10** [10] 313–18 (1931).

(10) "Stress Problems Overcome in Cemented Insulators," *Elec. World*, **100** [7] 221–22 (1932).

(11) "Soldered Porcelain and Glass in the Electrical Industry," *Ceram. Ind.*, **19** [6] 279–83 (1932).

(12) "Heat-Treatment of Electrical Porcelain," *Penn. State Coll. Mineral Ind. Expt. Sta. Bull.*, No. 14, pp. 77–83 (1933).

(13) "Present Practice and Developments in Firing Electrical Porcelain," *Jour. Amer. Ceram. Soc.*, **20** [1] 26–30 (1937).

(14) "Raw Material Requirements in Whiteware and Glass Industries," *Bull. Amer. Ceram. Soc.*, **16** [6] 231–33 (1937).

(15) (With H. C. Harrison) "Symposium on Importance of Thermal History: III, Effect of Thermal History on Physical Properties of Electrical Porcelain," *ibid.*, **18** [11] 420–21 (1939).

See p. 113, March, 1944, *Bulletin*, for photograph of Mr. Fritz.

ACTIVITIES OF THE SOCIETY

SOUTHERN CALIFORNIA SECTION

A meeting of the Southern California Section was held February 1, 1944, at Cook's Cafe, Los Angeles, Calif. Our attendance was about forty-six.

We were honored to have as our guests Harold H. Rosenberg and J. J. Svec, publisher and managing editor, respectively, of *Brick & Clay Record*, who gave some interesting facts pertaining to the ceramic industry.

Officers for 1944

The following officers of the Southern California Section were elected at a meeting of the Section held February 9, 1944:

Chairman: R. F. EVANS, Gladding, McBean & Co., Glendale, Calif.
Vice-Chairman: CLARE S. CHAFFEE, Latchford-Marble Glass Co., Los Angeles, Calif.
Secretary-Treasurer: GUY WURTSBAUGH, Pacific Clay Products, Los Angeles, Calif.

—GUY WURTSBAUGH, *Secretary*

UPSTATE NEW YORK SECTION

Minutes of Organizing Committee

Temporary Chairman M. H. Berns called a meeting of the Organizing Committee authorized by the organizing group which met January 29, 1944.* This Committee consisted of Robert E. Gould, Buffalo Pottery, Inc., Buffalo, N. Y.; Howard Failmezger, Victor Insulators, Inc., Victor, N. Y.; and Howard R. Lillie, Corning Glass Works, Corning, N. Y. Also present were M. H. Berns, Temporary Chairman, and E. E. Kunzman, Temporary Secretary.

This group decided that organization should be along the lines suggested in the October, 1938, *Bulletin of The American Ceramic Society*, p. 389, except that the office of Treasurer be combined with that of Secretary. Also, no dues are to be charged, but a registration fee of 50 cents will be charged at each meeting. Five meetings a year are to be held in each of the following cities: Buffalo, Rochester, Corning, Niagara Falls, and Hornell (Alfred). Meetings should be held on Friday evenings every other month, with the exception of the three summer months, June, July, and August, and should consist of a dinner with suitable entertainment, such as a speaker. It was suggested that plants in the vicinity be asked to underwrite the speakers' expenses if the amount of registration fees should not suffice.

It was decided to hold the first meeting in Buffalo on March 24, 1944, and Mr. Gould and Mr. Berns are to make necessary arrangements. A limit of $2.50 for dinner was decided on. Suggestions for name badges and seating arrangements were made to foster new acquaintance.

This group also decided that a resolution be prepared asking the Executive Committee to hold the 1945 Annual Meeting of The Society in Buffalo.

Following this meeting, the Nominating Committee, consisting of R. E. Gould, Chairman, Howard Failmezger, and H. R. Lillie, held a meeting.

—E. E. KUNZMAN, *Temporary Secretary*

February 29, 1944

* See *Bull. Amer. Ceram. Soc.*, **23** [3] 120 (1944).

INTERSOCIAL VOLITION

« « *Will of One Mind over Will of Another* » »

When Democratically Exercised by Elected Officials
With Lawful Court Recourse by All Parties Concerned
Free Enterprise Flourishes

When Exercised by Edicts and Directives
Without Recourse to Court Adjudication
Free Enterprise Is Threatened

Ceramists Federate and Collaborate in

The American Ceramic Society, Inc.

With Free Enterprise
To Promote Ceramic Science, Art, and Technology

PAID MEMBERSHIP AND SUBSCRIPTION RECORD

Date of Record	Members Paid		Deferred	Subscriptions	Monthly Sales	Total Circulation
	Personal	Corporation				
January 21, 1943	2079	267	11	444	220	3021
February 21, 1943	2095	267	10	451	220	3043
March 21, 1943	1765	262	8	416	220	2671
January 21, 1944	2110	323	4	531	220	3188
February 21, 1944	2147	330	4	540	220	3241
March 21, 1944	1844	323	4	523	220	2914

NEW MEMBERS IN MARCH

Corporation

FENTON ART GLASS CO., F. M. Fenton (voter), Williamstown, W. Va.

GEORGIA KAOLIN CO., Wharton Jackson (voter), 433 N. Broad St., Elizabeth 3, N. J.

KOPP GLASS, INC., C. E. Leberknight (voter), Swissvale, Pa. (formerly in name of C. E. Leberknight, personal member).

*NEW MARTINSVILLE GLASS CO., Max G. Biberthaler (voter), New Martinsville, W. Va. (formerly in name of Max G. Biberthaler, personal member).

SAVANNAH KAOLIN CO., F. H. Opper (voter), Box 184, Savannah, Ga.

STERLING CHINA CO., William T. Pomeroy (voter), East Liverpool, Ohio.

Personal

BAKER, HOUSTON R., 158 E. Third St., Corning, N. Y.; glass technologist, Corning Glass Works.

BEHREND, OSWALD, 823 Park Ave., Vineland, N. J.; Kimble Glass Co.

BUSH, JAMES W., 713 Climax St., Pittsburgh 10, Pa.; ceramist, Mesta Machine Co.

DUNCAN, RUSSELL F., 2122 Russell Ave., Parma, Ohio; Ferro Enamel Corp.

ELLIOTT, GEORGE, 10 Oakfield Rd., Cumbran, Newport, Monmouthshire, England; manager, Whitehead Hill & Co., Ltd.

EVANS, DANIEL O., Hillcrest and Linden Aves., Mapleview, Charleroi, Pa.; Corning Glass Works.

GROSSMAN, ISRAEL, 95 Madison Ave., New York, N. Y., Ednal Co., Inc.

HASSELBACH, WILLIAM, Libbey-Owens-Ford Glass Co., 1701 E. Broadway, Toledo, Ohio (membership formerly in name of G. B. Watkins).

HUGHES, CALVIN S., Arketex Ceramic Corp., Brazil, Ind.

JARRETT, LEGRAND, Fairmont Hotel, Fairmont, W. Va.; superintendent, Glass Plant, Westinghouse Electric & Mfg. Co.

*KAEPPEL, HERBERT V., Industrial Publications, Inc., 59 E. Van Buren St., Chicago 5, Ill.; executive editor, *Ceramic Industry* and *Brick & Clay Record*.

MACK, EDWARD, JR., 309 Walhalla Dr., Columbus, Ohio; head, Department of Chemistry, Ohio State University.

*MEACHAM, FLORAN L., 1009 Bonnie Brae, River Forest, Ill.; sales and service manager, Chicago Vitreous Enamel Product Co.

OLIVE, FRANK C., 515 Chamber of Commerce Bldg., Indianapolis, Ind.; attorney.

PLANKENHORN, W. J., Federal Electric Co., 8700 S. State St., Chicago, Ill. (membership formerly in name of E. R. Brauner).

POLAN, ALBERT, Zenith Optical Co., 832 Court St., Huntington, W. Va.

REDLICH, PAUL L., 562 Washington Blvd., Chicago, Ill.

*REMMEY, JOHN G., Richard C. Remmey Son Co., Hedley St. and Delaware River, Philadelphia, Pa.; treasurer and secretary.

SHAW, RONALD H., L. E. Shaw, Ltd., Halifax, Nova Scotia, Canada (membership formerly in name of L. E. Shaw).

STEIN, COLIN H., 39 Snowdon Place, Stirling, Scotland.

STRONG, JOHN, 46 Center Ave., Belmont, Boston, Mass.

TAYLOR, DOUGLAS J., 62 E. Market, Bethlehem, Pa.; Bethlehem Steel Co.

WAGNER, HAROLD F., 502R, Ninth Ave., Belmar, N. J.; War Department.

WARD, GEORGE W., 7555 South Shore Dr., Chicago, Ill.; Armour Research Foundation.

WILDENHAIN, MARGUERITE, Pottery Pond Farm, Guerneville, Calif.

Student

University of California: MRS. ELIZABETH B. MCCRONE.

University of Illinois: JORGE A. GUARDIA AND WILLIAM J. PRENTICE, JR.

New York State College of Ceramics: JAVIER H. FUENZALIDA AND RICHARD L. GALUSHA.

* Indicates former member of The Society rejoining.

MEMBERSHIP WORKERS' RECORD

CORPORATION: C. E. Bales 1, M. G. Biberthaler 1, J. F. Greene 1, R. O. Hummel 1, R. Russell, Jr. 1, D. E. Walsh 1.

PERSONAL: R. B. Adair 1, M. Corbman 1, E. C. Henry 1, Herbert Insley 1, Roland Lueders 1, J. J. Moran 1, W. L. Morgan 2, Colin Presswood 1, R. Russell, Jr. 1, F. L. Steinhoff 1, A. J. Weinstein 1, W. A. Weldon 1, I. F. Zeiller 1, Office 11.

STUDENT: W. M. Cohn 1, V. D. Fréchette 1, R. K. Hursh 2, J. J. Reimer 1.

GRAND TOTAL: 36.

ROSTER CHANGES FOR MARCH*

BRANDT, WILLIAM O., Stockton Fire Brick Co., Box 630, Pittsburg, Calif. (Los Angeles, Calif.)

CARPENTER, J. HALL, Rutile Mining Co. of Florida, Mill Creek Rd., South Jacksonville, Fla. (Niagara Falls, N. Y.)

FERGUSON, ROBERT F., 1010 Findley Ave., Zanesville, Ohio (Columbus, Ohio)

HUNTING, EVERETT C., Engineering Dept., Lamp Div., Westinghouse Electric & Mfg. Co., Bloomfield, N. J. (Plainfield, N. J.)

MCKEE, CAROLYN, R. D. 7, Mahoningtown, Pa. (New Castle, Pa.)

SPARLER, D. J., 87-41 130th St., Richmond Hill, N. Y. (Ozone Park, N. Y.)

* Address in parentheses is former address.

MEMBERS IN SERVICE*

The following members of this Society are in fighting units of war service. There are several in service in Washington not included in this Service Roster. This list, which was begun September, 1942, and added to each succeeding month, is probably not complete, and we would appreciate information on other members.

(266) A. RUSSELL ARNOLD, 515 Carolina Ave., Chester, W. Va.
(267) THOMAS J. BUTCHKO, Pennsylvania State College, State College, Pa.
(268) JOSEPH D. D'AMICO, Pennsylvania State College, State College, Pa.
(269) RICHARD D. PITMAN, Georgia School of Technology, Atlanta, Ga.
(270) CLYDE A. SANDERS, American Colloid Co., Chicago, Ill.
(271) RALPH H. WESTON, Arketex Ceramic Corp., Brazil, Ind.

* These are in addition to the lists published monthly, beginning with the September, 1942, *Bulletin*, with the exception of the June, 1943, issue.

PITTSBURGH SECTION

The third meeting of 1944 for the Pittsburgh Section was held March 14 in the Mellon Institute auditorium.

The meeting was opened by the secretary, John Jordan, who called on A. P. Thompson, local chairman in charge of the War Congress, for a short preview of the national meeting.

Owing to the illness of the speaker, Vincent Broomhall, art director of the Edwin M. Knowles China Co., Newell, W. Va., the program was taken over by J. W. Hepplewhite, chief ceramic engineer of the same company, who kindly consented to read the manuscript which the speaker had prepared, entitled "Thinking Ahead in Dinnerware."

The speaker's theme was centered about the idea that in designing for the postwar period the designer must think more and more in terms of machine production and that in doing so he becomes more closely related to the scientist and the engineer than ever before. That this is so is based upon the fact that at the present time the manufacture of chinaware, which is considerably more of a machine job than formerly, is still dependent to a great extent upon hand work. This is reflected in comparative figures for glassware and chinaware of 10 cents per dollar of total manufacturing cost for labor in the case of the former and 55 cents in the latter case. Much can be done, therefore, to bring the labor cost down so that more people can enjoy the utility and beauty of decorated chinaware. Various suggestions were offered for future developments in the mechanization of the industry.

Although competition from glass and also to some extent from plastics is keen, it seems reasonable to expect that the three will supplement each other rather than that one should supplant the others in the tableware industry.

Postwar planning involves three main paths: (1) Quality production; it is only through quality that healthy demand can be increased. Quantity cannot be the only consideration where good consumer and labor relations are concerned. (2) Service to the community; a factory benefits in more ways than one by maintaining high standards in regard to wages, working conditions, factory maintenance, and community relations. (3) Coordination of labor and management; this brings about a solid relationship between labor and management and benefits not only the company but the community as well.

Mr. Hepplewhite did a good job of substituting and went beyond the role of substitute by including observations from his own experience.

Joshua L. Miner, vice-president of the Atlas Lumnite Cement Company, will speak on hydraulic cements at the next Section meeting to be held May 9.

—J. W. JORDAN, *Secretary*

SALUTE TO SOME OF OUR MEMBERS

HOBART McKINLEY KRANER

Trustee from the Institute of Ceramic Engineers, 1944–1947

Born November 3, 1896, in Columbus, Ohio, Hobart McKinley Kraner attended the Columbus grade and high schools and was graduated from the Ohio State University with the degree of B.Cer.E. in 1921. After receiving the M.Sc. degree from the same school in 1922, he joined the staff of the U. S. Bureau of Mines Ceramic Experiment Station in Columbus as ceramic engineer. One year later, he went to the A C Spark Plug Co., Flint, Mich., as ceramic engineer and, in 1924, became superintendent of the Illinois Electric Porcelain Co., Macomb, Ill.

In 1925, he became associated with the Westinghouse Electric & Mfg. Co., Pittsburgh, Pa., first as a ceramic engineer in the East Pittsburgh laboratories (1925–1930) and then as superintendent of the porcelain plant in Derry, Pa. (1930–1932). Leaving the Westinghouse Electric & Mfg. Company in 1932, he joined the staff of the Corhart Refractories Co., Louisville, Ky., as research engineer.

He has held his present position of research engineer for the Bethlehem Steel Co., Bethlehem Pa., since 1935.

He received the professional degree of ceramic engineer from the Ohio State University in 1938.

Professional and Practical Achievements

Mr. Kraner has carried out research on high-temperature special porcelain (incorporating fused mullite) and special methods of processing electrical porcelain, including details of firing with special reference to rates of oxidation. He has also developed the process of crystal glaze application which eliminates fritting, is responsible for detailed improvements in mold making and handling of large pieces of cast porcelain, and has carried out research on casting electrocast refractories (including the use of cheaper raw materials, core compositions, and basic electrocast compositions) and glass stone identification and petrography of refractories. At present, he is doing research on refractory use in the steel industry.

Society Activities

Mr. Kraner has been a member of The American Ceramic Society since 1919 and was admitted to the Fellowship in 1931. Affiliated with the White Wares Division from 1925 to 1932, he served successively as a member of the Research and Papers and Program Committees, Secretary, and Chairman. He has been affiliated with the Refractories Division since 1932 and has served as a member of the Papers and Program Committee (1934–1935), Secretary (1935–1936), Vice-Chairman and member of the Membership Committee (1936–1937), Chairman (1937–1938), and member of the Nominating Committee (1938–1939). He also served as chairman of The Society Research Committee in 1926.

A member of the Founder's Group of the Institute of Ceramic Engineers, Mr. Kraner served as president of this class in 1942–1943.

He is also a member of Sigma Xi and Keramos.

Publications

(1) "Sillimanite Development in Some Typical Clays," *Jour. Amer. Ceram. Soc.*, **7** [10] 726–34 (1924).
(2) "Colors in Zinc Silicate Glaze," *ibid.*, [12] 868–77.
(3) (With S. J. McDowell) "Talc as Principal Body Ingredient in Vitrified Ceramic Bodies," *ibid.*, **8** [10] 626–35 (1925).
(4) (With S. J. McDowell) "Effect of Heat on Strength of Calcined Kieselguhr-Portland Cement Mixtures," *ibid.*, [11] 784–88.
(5) "Use of Eutectics as Glazes," *ibid.*, **9** [5] 319–23 (1926).
(6) (With A. H. Fessler) "Redesigned Driers," *ibid.*, [10] 679–83.
(7) "Selection of Porcelain for Electrical Purposes," *Elec. Jour.*, **23** [7] 344–48 (1926).
(8) (With E. H. Fritz) "Study of Some Factory Processes," *Jour. Amer. Ceram. Soc.*, **10** [5] 357–66 (1927); reprinted in *Ceram. Ind.*, **8** [5] 540–43 (1927).
(9) (With A. H. Fessler) "Hydrogen-Ion Concentration and Electrical Conductivity of Clay Slips: I, Plant Study," *Jour. Amer. Ceram. Soc.*, **10** [7] 501–507 (1927); "II, Laboratory Study," *ibid.*, [8] 592–97.
(10) (With A. H. Fessler) "Vacuum Treatment of Clay Slips and Bodies," *ibid.*, **11** [10] 725–29 (1928).
(11) "Effect of Heat-Treatment on Diatomaceous Earth," *ibid.*, [12] 875–83.
(12) "Systems of Paying Workmen," *Ceram. Age*, **11** [5] 174–76 (1928); *Ceram. Ind.*, **10** [6] 632–34 (1928).
(13) (With E. H. Fritz) "Rate of Oxidation of Porcelain and Ball Clays," *Jour. Amer. Ceram. Soc.*, **12** [1] 1–13 (1929).
(14) "Importance of Glass Phase in Porcelain," *ibid.*, [6] 383–89.

(15) "Ceramic Developments in Electrical Industry during 1928," *Ceram. Ind.*, **12** [2] 214–15 (1929).
(16) "Ceramic Developments in Electrical Industry during 1929," *Ceram. Age*, **15** [1] 31–35 (1930).
(17) (With R. A. Snyder) "Apparatus for Determination of Adsorbed Air," *Jour. Amer. Ceram. Soc.*, **13** [1] 11–15 (1930).
(18) "High-Voltage Insulators," *Glass Ind.*, **11** [5] 117 (1930).
(19) "Cost and Quality Ban Wheelbarrow in Ceramics," *Chem. & Met. Eng.*, **37** [4] 235–37 (1930).
(20) "Super-Refractories for Higher Temperatures: Zircon, Magnesia, and Chrome-Silica," *ibid.*, [9] 589.
(21) "Uniformity in Refractories Manufacture," *Steel*, **88** [4] 47 (Jan. 22, 1931).
(22) (With R. A. Snyder) "Mechanical and Thermal-Shock Tests on Ceramic Insulating Materials," *Jour. Amer. Ceram. Soc.*, **14** [9] 617–23 (1931).
(23) "Electrical Resistivity of Refractory Materials at Elevated Temperatures," *Ind. Eng. Chem.*, **23** [10] 1098–1102 (1931).
(24) "Electrical Porcelain," *Elec. Eng.*, **50**, 209–11 (1931).
(25) "Developments in Electrical Industry in Glass, Enamel, and Pottery," *Ceram. Ind.*, **18** [1] 12–13 (1932).
(26) "Microstructure of Electrical Porcelain Glazes," *ibid.*, **21** [2] 73–75 (Aug., 1933).
(27) (With F. S. Thompson) "Refractories for Manufacture of Glass," *Ind. Eng. Chem.*, **25** [8] 856–64 (1933).
(28) "Development of Slagging Test for Refractories," *Metals & Alloys*, **9** [4] 79–83 (1938).
(29) "Some Considerations in Production of Fused Mullite for Refractories," *Jour. Amer. Ceram. Soc.*, **21** [10] 360–66 (1938).
(30) "Alumina and Silica Refractories," *Iron Age*, **145** [3] 25–30; [4] 34–39 (1940).
(31) "Refractories Service Conditions in Blast Furnace," *Jour. Amer. Ceram. Soc.*, **25** [11] 311–20 (July, 1942).
(32) "Mechanism of Wear of Blast-Furnace Linings," *Steel*, **111** [9] 66–75 (Aug. 31, 1942); **111** [10] 82, 130–32 (Sept. 7, 1942).
(33) "Selection of Clay Refractories." In process of publication by the American Institute of Mining and Metallurgical Engineers.

Patents

(1) "Salt Glazing in Colors," U. S. 1,728,766, Sept. 17, 1929.
(2) "Insulator," U. S. 1,813,172, July 7, 1931.
(3) "Electrodeposition of Porcelain," U. S. 1,907,984, May 9, 1933.
(4) "Producing Glass," U. S. 1,933,739, Nov. 7, 1933.
(5) (With F. W. Schroeder) "Mold for Casting Basic Refractories," U. S. 2,011,489, Aug. 13, 1935.
(6) "Friable Core for Molds," U. S. 2,071,542, Feb. 23, 1937.
(7) "Forming Ceramic Bodies," U. S. 2,075,445, March 30, 1937.
(8) "Ceramic Composition," Can. 373,532, May 3, 1938.
(9) "Synthetic Ore," U. S. 2,308,984, January 19, 1943.

See p. 114, March, 1944, *Bulletin*, for photograph of Mr. Kraner.

KENNETH CASSINGHAM LYON

Chairman of the Glass Division, 1944–1945

Kenneth Cassingham Lyon was born in LaHarpe, Ill., January 22, 1908, and attended and was graduated from the grade and high schools of that city. He entered Knox College, Galesburg, Ill., in September, 1926, and followed a liberal arts course of study until 1928. He then entered the Ceramic Engineering course at the University of Illinois, Urbana, Ill., and was granted a Bachelor of Science degree, with high honors, in 1931. A Master of Science degree in ceramic engineering was received in 1933, and the degree of Doctor of Philosophy in engineering was granted in 1936.

During the period of study at the University of Illinois, he held a ceramic scholarship from 1928–1931, was a research graduate assistant in the Engineering Experiment Station from 1931–1933, and was a University Service Fellow from 1933–1935.

Before 1929, Dr. Lyon was employed by the Lacledé-Christy Clay Products Co., St. Louis, Mo., for several summers. During his course at the University of Illinois, he worked for members of the Ceramic Department staff, assisting them in their investigations and consulting practice. From 1935–1940, he was employed as a ceramic engineer by the Glass Technology Laboratory of the General Electric Company in Cleveland, Ohio, where he worked with special glasses, refractories, and ceramic problems connected with the making of electric lamps.

In 1940, he entered the employ of the Armstrong Cork Company in the Whitall-Tatum Division at Millville, N. J., as assistant chief chemist. He was made chief chemist in 1942.

Kenneth Cassingham Lyon

Dr. Lyon is a member of The American Ceramic Society, having joined as a Student Member in 1929. He was a member of the Deutschen Keramischen Gesellschaft in 1939 and 1940. In addition to these he holds membership in Phi Kappa Phi, Sigma Xi, Tau Beta Pi, Keramos, Sigma Tau, and Phi Gamma Delta. He is a member of the Millville Kiwanis Club and is active in Boy Scout and church work of the community. He was president of the Illinois chapter of Keramos in 1930–1931. He served as secretary-treasurer and president of the University of Illinois Alumni Club of Cleveland. He was appointed

second vice-chairman of the Glass Division in 1942 and, as vice-chairman for 1943–1944, arranged the Division program for the 1944 Annual Meeting.

Dr. Lyon married Miss Kathryn Walker of DeLand, Ill., in 1932 and has three children, John, Julia, and Lucy. Julia is named for Mrs. C. W. Parmelee.

Publications

(1) (With C. W. Parmelee) "Study of Some Frit Compositions," *Jour. Amer. Ceram. Soc.*, **17** [3] 60–66 (1934).

(2) (With C. W. Parmelee) "Investigation of Use of Magnesium Aluminate (Spinel) as Material for Glass-melting Containers," *ibid.*, **18** [11] 338–40 (1935).

(3) (With J. H. Chesters and G. L. Clark) "Firing Magnesite Brick: III, Crystal Size Determination by Laue Diffraction Method," *Trans. Ceram. Soc.*, **34** [4] 243–49 (1935).

(4) (With C. W. Parmelee) "Effect of Composition on Scratch Hardness of Certain Glasses," *Glass Ind.*, **17** [6] 191–93 (1936).

(5) (With C. W. Parmelee) "Maximum Bubble-Pressure (Jaeger) Method for Measuring Surface Tension of Molten Glass," *Jour. Soc. Glass Tech.*, **21** [83] 44–52 (1937).

(6) "Effect of Surface Tension on Seedy Glass," *Ceram. Ind.*, **28** [2] 138 (1937).

(7) (With C. W. Parmelee) "Surface Tensions of Molten Glasses, I," *Univ. Illinois Eng. Expt. Sta. Bull.*, No. 311, pp. 5–27 (1939).

(8) (With R. F. Scott) "Thermal-Shock Testing of Lime-Glass Insulators by A.S.T.M. Method D–468 vs. Preston Apparatus (A.S.T.M. C–149)," *A.S.T.M. Standards on Electrical Insulating Materials*, p. 469 (Feb., 1944).

A. PAUL THOMPSON

Dr. Thompson ably served as General Chairman of the Committee on Arrangements for the Annual Meeting of The American Ceramic Society held in Pittsburgh, Pa., April 2–5. He and his entire Committee are to be commended for the competent way in which they carried out their many duties.

A. Paul Thompson

A. Paul Thompson was born in Florence, Colo., November 6, 1893. Because of the character of his father's work—he was associated with the U. S. Bureau of Fisheries—the family was frequently on the move in those early years spending various intervals of time in the Midwest, New Hampshire, Colorado, and Montana. During one of these sojourns in Colorado, two notable things from Paul's point of view occurred: he was graduated from the high school at Leadville, Colo., a mining town two miles above sea level, and spent the summers scampering over the mountains at still higher elevations, for Mount Massive, considered to be the highest point in Colorado at that time, was in his back yard.

After a year spent earning money for a college education by working at Fairport, Iowa, known the length of the Mississippi River as "Jugtown" owing to the character of its ceramic product, he entered Iowa State College, Ames, Iowa, in 1911 and a year later transferred to Montana State College, Bozeman, Mont., from which school he received the degree of B.S. in industrial chemistry in 1915. The ensuing seven years were spent with the Anaconda Copper Mining Company at Anaconda and Great Falls, Mont., as assistant testing engineer, research engineer, assistant chief chemist, and chief chemist.

Feeling the desire for more education, he then undertook graduate work at the University of Illinois, Urbana, Ill., receiving an M.S. degree in 1923 and the Ph.D. degree in chemistry in 1925. While at Illinois he also acted as an assistant in chemistry and during the last year held the Du Pont fellowship.

For the ensuing two and one half years, he was a research engineer for the General Chemical Co., Laurel Hill, L. I. From January, 1928, to March, 1932, he was employed as a research engineer and consultant for the International Nickel Company of Canada, Ltd., at Copper Cliff, Ontario, and New York City.

Since March, 1932, Dr. Thompson has been at the Mellon Institute of Industrial Research, Pittsburgh, Pa., on the abrasives fellowship, sponsored by the Carborundum Company.

He has been a member of The American Ceramic Society since 1933. He is also a member of the American Chemical Society and a Fellow of the American Association for the Advancement of Science. In addition, he is a member of Sigma Xi, Epsilon Chi, and Phi Lambda Upsilon.

He has interested himself in the activities of various technical societies in the Pittsburgh area, particularly in the Local Section of The American Ceramic Society. Currently he is treasurer of the Pittsburgh Chemists' Club and president of the Robert Kennedy Duncan Club of Mellon Institute. He was vice general chairman of the Pittsburgh committee which staged the Annual Meeting of The American Ceramic Society in 1943.

Publications

Among his publications may be listed the following:

(1) "Preparation and Properties of Cerium-Free Misch Metal," *Trans. Electrochem. Soc.*, **47**, 345 (1925).

(2) "Preparation and Some Properties of Metallic Yttrium," *ibid.*, **49**, 277 (1926).

(3) "Platinum vs. Vanadium Pentoxide as Catalysts for Sulphuric Acid Manufacture," *Trans. Amer. Inst. Chem. Engrs.*, **27**, 264 (1931).

(4) "Which Sulphuric Acid Catalyst—Platinum or Vanadium?" *Chem. & Met. Eng.*, **38**, 705 (1931).

(5) " 'Monofrax' Refractories," *Glass Ind.*, **18** [11] 363–66, 385–86 (1937).

(6) "New High-Alumina Super-Refractory for Use in Glass Tanks," *Ceram. Ind.*, **29** [5] 360–61, 378 (Nov., 1937).

Patents

Dr. Thompson is the holder or co-holder of almost thirty United States and Canadian patents in the fields of metallurgy and chemical and ceramic technologies.

LOIS CAROLYN McKEE AN AIR-WAC

Lois Carolyn McKee, a member of The American Ceramic Society and a member of the Engineering Department of the Universal Sanitary Mfg. Co., New Castle,

Pa., has been accepted as the first Air-WAC to enroll from the recruiting office in New Castle.

Miss McKee was born in Coraopolis Heights twenty-three years ago. She attended Antioch College for two years and the Art Institute, Pittsburgh, Pa., for two years.

She joined the Engineering Department of the Universal Sanitary Mfg. Company in 1942, where she has worked at drafting and in compiling and interpreting results from the laboratories.

Lois Carolyn McKee

JOHN B. CAHOON, JR.

John B. Cahoon, Jr., a graduate of Ohio State University, has been appointed to the research staff of Battelle Memorial Institute, Columbus, Ohio, and assigned to its division of ceramics.

Mr. Cahoon, who holds the degree of Bachelor of Ceramic Engineering, was formerly employed at the Engineering Experiment Station, Ohio State University. He is a member of The American Ceramic Society.

John B. Cahoon, Jr.

NECROLOGY

CHARLES JOSEPH HARRIS*

Charles Joseph Harris, prominent Western North Carolina capitalist and president of the Harris Clay Co., Dillsboro, N. C., died February 14, 1944, in his ninetieth year at the home of his son, Robert W. Harris, in Biltmore Forest, N. C.

He had suffered a broken hip in 1935 and another one in 1938 and since that time had been bedridden, spending his last years at the home of his son.

He was also president of the Jackson County Bank at Sylva, the Spruce Pine Bank, the Harris Granite Quarries with headquarters in Salisbury, and the Harris-Woodbury Lumber Company and vice-president of the American National Bank and stockholder in the Wachovia Bank and Trust Company.

Established Tannery

In 1903, Mr. Harris gave Jackson County its first industry of any size, establishing at that time the C. J. Harris Tannery at Sylva. He operated the Tannery until 1916, when he sold it to the Armour Leather Company. He built on the Tuckaseegee River at Dillsboro the power plant for the Sylva and Dillsboro Electric Light Company.

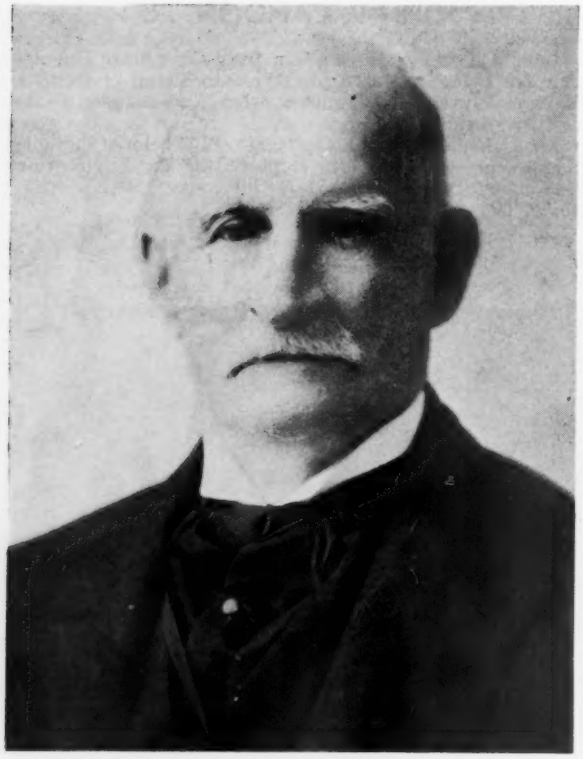
Going to Jackson County in 1888, Mr. Harris and his brothers purchased the Carolina Clay Company. Then was launched the clay products industry which has operated in Jackson, Swain, Haywood, Mitchell, Yancey, and Avery counties.

He at one time owned 76,000 acres of the land now in the Great Smoky Mountains National Park. This land was sold to the Norwood Lumber Company and the Champion Paper and Fibre Company.

Provided Memorial Tower

Mr. Harris provided $30,000 for the erection of the Elisha Mitchell Memorial Tower on Mt. Mitchell, which he gave to the State of North Carolina unconditionally.

* From *The Asheville Citizen*, February 15, 1944.



Charles Joseph Harris

Harris High School of Spruce Pine is named for him, a citizen who did much toward the industrial development of that section of the State.

Mr. Harris was a staunch Republican. He was a delegate-at-large to the Republican National Convention at Chicago in 1908 and attended every national convention of his party from 1892 to 1936.

From 1898 to 1902, he was a member of the U. S. Industrial Commission.

Yale Graduate

A native of Putnam, Conn., Mr. Harris was the son of William and Zilpah Torrey Harris. He attended the schools of his home town and was graduated from Yale University in the class of 1874. At the latter institution he was a fraternity brother of William Howard Taft.

From Yale, Mr. Harris went to the St. Louis Law School. After completing his work there, he took a position as teacher in a Kansas high school. Then he went to Denver where he taught for another year.

Some time after this, he went into the hardware business, switching from this to the building of irrigation canals in the West. Mr. Harris gained much of his wealth during this phase of his business career.

His industrial and financial career in Western North Carolina followed.

Mr. Harris married the former Miss Florence Rust of Detroit, who died in 1918.

A brother, the late Dr. William T. Harris, was U. S. Commissioner of Education for approximately three decades.

The mountain-area industrialist served for a time as president of the Yale University Alumni Association in North Carolina and was a member of the Metropolitan Club, Washington, D. C.; the University Club, New York, N. Y.; and the Biltmore Forest Country Club.

Robert W. Harris, Mr. Harris' only immediate survivor, is vice-president of the Harris Clay Company and a member of The American Ceramic Society.

NOTES FOR CERAMISTS

MUNSELL COLOR FOUNDATION ESTABLISHED

The science of color in the United States covers an active and growing field. A recent event of real importance is the establishment of the Munsell Color Foundation, Inc.

The Munsell Color Company for twenty-two years has carried on the task passed on by Albert H. Munsell at the close of his lifetime of color research and teaching. His family, as owners of the Company, have seen the theories and practical suggestions originated by Mr. Munsell carried into many fields and have been pleased to know that his system of color notation is recognized by an increasing number of artists, scientists, industrialists, educators, and the general public.

Believing that the time had arrived when the ownership of the Company and the responsibility for carrying on this work should be placed in the hands of the persons having the broadest knowledge of color and its problems and being most interested in the advancement of color knowledge, the owners have taken part in the creation of a foundation whose corporate name is "The Munsell Color Foundation, Inc." and have transferred to the Foundation their stock in the Munsell Color Company, Inc.

The purpose of the Foundation is "to further the scientific advancement of color knowledge and, in particular, knowledge relating to the standardization, nomenclature, and specification of color, and to promote the practical application of these results to the color problems arising in science, art, and industry."

The Foundation is a nonprofit organization whose management is intrusted to a Board of Trustees selected as follows: "One. . . shall be a member of the staff of the National Bureau of Standards who shall have been designated by the Director of said Bureau; one. . .shall be designated by the Executive Committee of the Inter-Society Color Council; one. . .shall be the person who, from time to time, shall be the manager of the Munsell Color Company, Inc.; one. . .shall be the representative of Juliet E. Orr Munsell and her son Alexander E. Orr Munsell; there shall be three Trustees-at-Large."

The first Board of Trustees consists of Deane B. Judd, trustee appointed by the Director of the National Bureau of Standards, elected president; Loyd A. Jones, trustee-at-large nominated by the Optical Society of America, elected vice-president; Blanche R. Bellamy, manager of the Munsell Color Company, Inc., elected secretary; Dorothy Nickerson, trustee appointed by the Inter-Society Color Council; Alexander E. O. Munsell, trustee representing the Donor; and Arthur S. Allen and I. H. Godlove, trustees-at-large. Each member of this Board is already well known in color science or in industry.

The Munsell Color Company, under the guidance of the Foundation, will continue the services it has heretofore rendered and, when possible and its work is needed, will extend its activities into new fields.

OSTWALD COLOR SYSTEM*

The first afternoon session of the winter meeting of the Optical Society of America held at the Hotel Pennsylvania, New York, N. Y., March 2, 1944, was devoted to a Symposium on the Ostwald Color System, the system of

* A press release from the Color Laboratories Division of the Container Corporation of America.

color organization originally developed by Wilhelm Ostwald, great German scientist. The presiding officer was Deane B. Judd. There were four invited papers.

Herman Zeishold of Van Ameringen-Haebler, Inc., discussed "The Philosophy of the Ostwald Color System." Mr. Zeishold, chemist and former student of Dr. Ostwald, recalled that Wilhelm Ostwald enjoyed a universal reputation as a co-founder of physical chemistry, but pointed out that his later work in natural philosophy and his research in color, its immediate offspring, are less widely known in this country. Mr. Zeishold emphasized Dr. Ostwald's interest in the psychological properties of visual sensation and their measurement.

Carl E. Foss, color consultant, who did the developmental and production work on the Color Harmony Manual and Index,* presented an "Analysis of the Ostwald Color System." He showed how the ideal Ostwald color system could be developed from the color equation and semichrome theory described by Ostwald. These data were determined for the standard observer and daylight illuminant of international agreement.

The results of measurements of samples in previous Ostwald albums were presented and compared with equivalent points in the ideal Ostwald system. Despite the limitations imposed by available colorants upon the preparation of a collection of color samples, an arrangement which preserves the principle Ostwald concepts, viz., (1) the monochromatic triangle (constant dominant wave length), (2) the complementarism of opposite triangles, and (3) constant purity of the shadow series, was outlined.

Walter C. Granville, color technologist at the Interchemical Corporation Research Laboratories, presented a paper on "Colorimetric Specification of the Color Harmony Manual from Spectrophotometric Measurements." He pointed out that in both the United States and Canada an increasing number of persons are becoming interested and are using the Ostwald system of color notation for developing color harmonies and for purposes of color specification. Thus, it is desirable that basic colorimetric specifications be determined for the most recent and comprehensive production of color chips based on the Ostwald system. Such chips are embodied in the handbooks of the Color Harmony Manual published by the Color Laboratories Division of the Container Corporation of America.

Colorimetric specifications have been computed for the ICI standard observer and illuminant C from spectral reflectance curves on the 680 chips in the Color Harmony Manual. A portion of these colorimetric data was compared with similar data on earlier productions of color samples based on the Ostwald system.

These colorimetric data specifically add to the value of the color chips as standards. In addition, they permit conversion from this recent production of color samples to others similarly standardized.

Faber Birren, author and color consultant, talked on the "Application of the Ostwald System to Design of Consumer Goods." He told how, after having studied many of the major color systems as a student, he learned that in the everyday world of designing consumer goods these theories were not practical because they were not universally valid. Then, years later, he found that the Ostwald system of color harmony provided the broad foundation necessary for any work in color. In his talk Mr. Birren stressed the importance of correct and workable *general* principles, as opposed to minor rules and limitations, and it is here that he feels the Ostwald system to be a source of practical inspiration.

The application of the Ostwald organization of the colors to industry was illustrated by several charts. Among these was the striking arrangement of fabrics designed by Pola Stout and produced by Botany Worsted Mills. These fabrics were developed not only to provide extensive and well-balanced wardrobes but to assure harmonious color combinations. Mrs. Stout has long been an admirer and follower of Dr. Ostwald's system.

Another series of charts was devoted to the use of the Ostwald standards in the preparation of color pages for Sears-Roebuck under the direction of Mary Lewis and Mrs. Helen Taylor. In these charts it was shown that the standards were used in selecting color for merchandise, in controlling color photography and engraving, and in communication between departments generally.

Other displays showed reference to the Ostwald colors by the Higgins Ink Company; Fiatelle, Inc.; the Faber Birren Company; and the Container Corporation of America.

* Abstracted in *Ceram. Abs.*, **21** [10] 206 (1942).

PEMCO CORPORATION DOUBLES LABORATORY FACILITIES

Though previously acknowledged to possess one of the most complete and adequately manned research laboratories in the porcelain enameling industry, the Pemco Corporation, Baltimore, Md., has just completed the entire renovation of its research facilities. Thousands of dollars' worth of new equipment has been added and additions have been made to the personnel.

In discussing the reason for these changes, Harold G. Wolfram, vice-president in charge of engineering, said, "Under the supervision of G. H. Spencer-Strong, the personnel of the Pemco Lab has always been the finest that could be assembled. And constant development of new ceramic finishes and improvements and modernization of standard frits are always under way. . . . Durable goods will, undoubtedly, be among the first items to go into postwar production. As a matter of fact, their manufacture might possibly start even before the end of the war. That the demand for durable goods—refrigerators, washing machines, and innumerable other items requiring porcelain enamels—will be beyond anything that we have ever previously experienced is a foregone conclusion. . . . Undoubtedly, other finishes of various types will also, for a while, be given some consideration under the impression of economy. It is our firm belief, however, that the entire porcelain enameling industry will experience the most productive period it has ever known. Fortunately, Pemco Corporation is in the position of being able to keep ahead of this demand and to adjust its facilities accordingly so as to adequately take care of the accelerated requirements for service and advice that unquestionably will develop."

CORNING GLASS WORKS HAS ARGENTINE PLANT

Lawrence King has been appointed managing director of the Corning Glass Works of South America, a wholly owned Corning Glass Works subsidiary established in Buenos Aires in 1943. Mr. King's duties also may require his spending some time in Brazil and Chile.

Corning Glass Works of South America has acquired a stock interest in Cristalerias Rigolleau, a long-established South American glass manufacturing company, which, as soon as conditions permit, may undertake the production of a number of Corning's specialty products that are now exported to the Argentine market.

Mr. King, who became associated with the Corning Glass Works in 1941, was formerly a factory superintendent in France for the St.-Gobain Company, a large French manufacturing company. An experienced glass technologist and engineer, he had been working at the Corning, N. Y., and Charleroi, Pa., plants of the Corning Glass Works until the time of his new appointment.

Each NEW MEMBER You Obtain Adds Value To Your Membership Investment in THE AMERICAN CERAMIC SOCIETY

ELECTRONICS AND THE GLASS INDUSTRY *

By H. C. Steiner

Abstract

There are many interesting applications in which electronics have been used to solve industrial problems. In some, such as the use of ignitrons as a switch for welding control or as rectifiers for the conversion of alternating current into direct, the electronic devices carry the full power involved. In many, the function is primarily one of providing a faster, simpler, more precise, or more responsive control for other apparatus, and the electronic device becomes only one coordinated part of the whole. Almost all of the applications involve the use of several types of electronic tubes, and it is the purpose of this paper to describe the salient characteristics of the tubes and some typical industrial applications.

I. Introduction

In considering K. C. Lyon's request for a talk on "Electronics in the Glass Industry," it was evident that we might speak with more authority on the reversed subject "Glass in the Electronic Industry." Glass is one of the most essential and important materials used in electronics. It serves as a vacuum container and as an insulator and, in addition, must possess the unique characteristic of being able to seal to metallic leads, as we are concerned with the problem of conducting current in and out of the vacuum container. The expansion of glass increases rapidly near the annealing temperature, whereas most of the common sealing metals such as tungsten expand uniformly through this temperature range. The industry recognized the inherent limitation of such seals and set out to develop an alloy whose characteristics would match those of glass. As a result, an alloy, fernico, and a matching borosilicate glass were produced which have greatly increased the current capacity of sealed vacuum tubes. The leads of the ignitron tubes, for example, carry currents of several thousand amperes.

II. Historical Background

The electronic industry is founded on a knowledge of the behavior of the electron under electric and magnetic fields, its effect on other materials, and methods for its control. The electron itself is considered to be the smallest division of matter; it is the basic negative indivisible unit of electricity. It has a mass equivalent to $^1/_{1830}$ that of the hydrogen atom and a negative charge of 4.77×10^{-10} electrostatic units. In everyday language, it requires 6.182×10^{18} electrons to conduct one ampere for one second. In the electronic tube, these electrons are essentially free compared to their state in a conducting wire; i.e., the length of path in a high-vacuum tube may vary from one to several inches, depending on the type of tube. In the passage through the vacuum, these electrons build up a space charge (as described by Langmuir) such that the voltage across the tube increases as the three halves power of the current. The magnitude of the voltage drop across transmitting tubes is of the order 100 to 1000 volts, depending on the size and design, whereas that across X-ray tubes may vary from 50,000 to 1,000,000 volts. If a low pressure (10 to 100 microns) of an inert gas or vapor, such as argon or mercury, is introduced into the same tubes, the travel of the electrons becomes much shorter (fractions of an inch) before striking a gas molecule. If the electron energy is sufficient, it ionizes the gas by dislodging an electron from a gas molecule, thereby giving rise to a positively charged ion and two electrons. The ionization potential of most gases is low (of the order of 10 to 20 volts), and the tubes employing gas have low losses and, in general, are capable of carrying relatively high currents. In a still denser medium, such as a conducting wire, the electron path decreases to the order of 10^{-8} cm. and the electron is, in a sense, no longer free.

The nomenclature describing the several types of electronic tubes, such as kenotron, pliotron, and phanotron, was initially introduced by Dr. Langmuir and L. A. Hawkins, of the General Electric Research Laboratory. The names were coined from the Greek word "tron," meaning an instrument or device and a prefix which is characteristic of the particular type of device. For example, the prefix of the term "pliotron," describing the usual three-electrode vacuum tube, comes from the Greek word "pleion," meaning more. The connotation in this case is the amplification which such a tube gives. "Kenos," meaning empty, is indicative of the high vacuum in the kenotron tube. "Thyra," in "thyratron," signifies a door and is characteristic of the open or closed control feature of the thyratron tube.

III. Phototubes

The phototube is a vacuum or gas-filled tube whose current is proportional to the amount of light falling on the tube. The current is small, usually of the order of 15 microamperes or less and for most uses must be amplified through either pliotron or thyratron tubes. Different designs permit maximum response in either the red or blue ends of the spectrum.

The phototube has a wider and more varied range of applications than any other type in the electronic family. In the amusement field, it is used for sound reproduction by the motion-picture industry, in shooting galleries as the objective for light-beam machine guns and rifles, and in pin-ball machines. For protection, it detects fire, smoke, and burglars. Industrially, it is used for counting, opening doors, automatic weighing of liquids or solids, control of light, temperature measurements, and literally dozens of similar applications. Figure 1 shows a typical group of phototube relays and controls.

* Presented at the Autumn Meeting of the Glass Division, September 15, 1943. Received December 27, 1943.

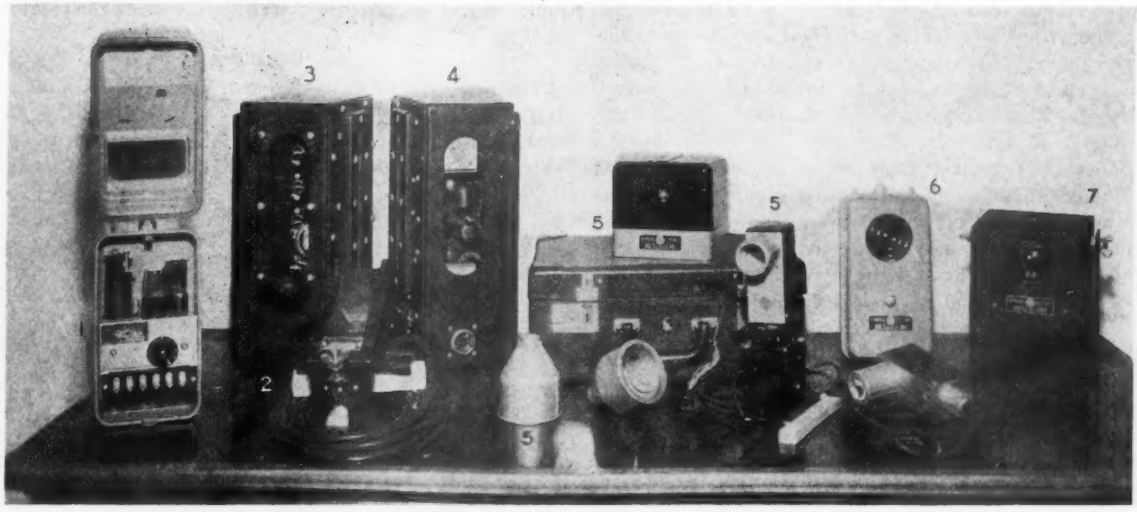


FIG. 1.—A group of photoelectric control relays and accessories: (1) "Novalux" relay; (2) phototube holder for (1); (3) light source for loop control; (4) phototube holder for loop control; (5) general-purpose relay and accessories; (6) and (7) photoelectric relays.

One interesting and unusual application is the sorting of navy beans. In maintaining quality standards, it is important that these beans be all white and that the occasional black bean be discarded. To accomplish this, the beans are sent in single file on an endless belt past the phototube. As long as the beans are white, the light conditions are satisfied and the beans are permitted to proceed. If a black bean appears, however, the phototube operates to open a small jet of air which immediately blows the offending bean into the discard.

A more exacting use is in the control of the relative speeds of the paper and printing rolls in color printing. In this case, it is necessary to maintain the several color rolls in correct register with the paper to within 0.002 to 0.003 inch to prevent a blurred or unattractive picture. The paper meanwhile is moving at speeds of 400 to 1000 feet per minute. To control this, small bars are printed along one side of the paper approximately 5 to 6 inches apart. The phototube is focused on the side of the paper (Fig. 2) and therefore gives a signal each time a bar passes. A corresponding signal is received from the rolls and, if the two signals coincide, there is no change. If the paper, however, is lagging behind the roll, the impulses are translated through additional electronic apparatus to increase momentarily the speed of the motor driving the paper. At the higher speeds, it is necessary to control simultaneously the relative speeds of both the paper and the rolls. In this, as in many applications, the electronic control is a small but vital part of the total apparatus involved.

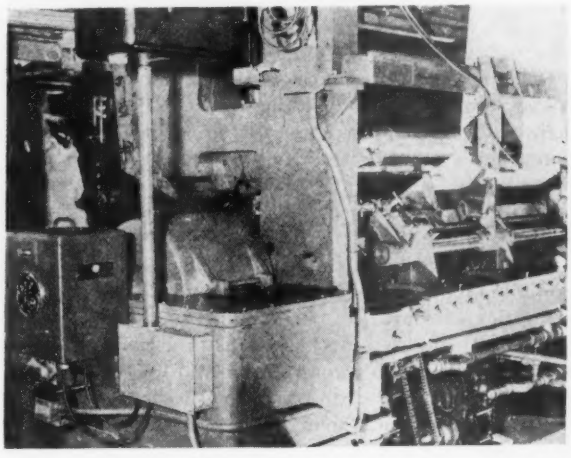


FIG. 2.—Photoelectric multicolor register for rotogravure press. View of drive side showing complete color-unit equipment including mixing panel (*top*), web scanner (*right*), disk scanner (*left*), and fractional-h.p. gear motor for cylinder correction (*bottom*).

IV. Pliotrons

The high-vacuum pliotron tubes are most widely known for their use in radio. Radio-transmitting tubes in this service vary in current capacity from a few milliamperes to approximately 50 amperes and operate at potentials of

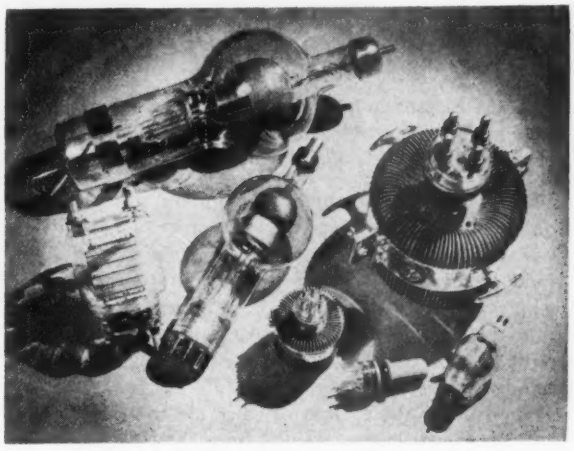


FIG. 3.—A group of pliotron and phanotron tubes for radio-transmitting service.

1000 to 20,000 volts. One of the ratings for the tubes is heat dissipation, which may vary from a few watts in the smaller tubes to 100 kilowatts in the larger sizes. Cooling is accomplished by natural radiation and convection, forced air, or water, depending on the size. A few of the various designs are shown in Fig. 3.

Industrially, the use of high-frequency current for induction heating is finding an increasing number of important applications. Induction heating represents one of the earliest uses of electronics in industrial problems. It is the standard method of heating the internal parts of electronic tubes during manufacture. Similarly, the ability to generate heat locally at the source of trouble is used in the therapeutic treatment of certain muscular congestions. More recently, the ability to control the depth of heat penetration has drawn attention to this method of heating for the surface hardening of steel and for the softening of plastics. There are three fairly distinct frequency ranges for different types of work. For many applications of induction heating or melting of metals, frequencies of 1000 to 10,000 cycles are used, and the power is usually obtained from motor generator-type frequency changers. For surface hardening of small steel parts, such as the teeth of gears, the high frequencies obtainable from electronic equipment are particularly advantageous. Figure 4 shows typical electronic heating equipment which provides power at 540 kilocycles for hardening gear teeth.

FIG. 4.—Electronic heating equipment for surface hardening of gear teeth. A quenching ring for spraying water on the gear surrounds the coil.

For the dielectric heating of plastics and insulating materials, still higher frequencies of the order of 3,000,000 to 25,000,000 cycles are used. In plastic molding, the plastic should be heated uniformly throughout to the molding temperature, but as the material itself is a rather poor heat conductor, heating from external means is usually a slow and uneven process. With dielectric heating, the heat is generated uniformly in the material itself.

Some idea of the extent to which electronic heating is being employed may be gained from the fact that many more times the amount of power is utilized for this work than for radio broadcasting. Power requirements for radio were of the order of 3500 kilowatts at the beginning of 1943.

V. Thyratrons

The thyratron tubes used industrially range from 0.5 to 100 amperes in current capacity. The usual operating potential is from 100 to 1000 volts and the maximum is 15,000 volts. Figure 5 shows a group of glass and metal thyratrons.

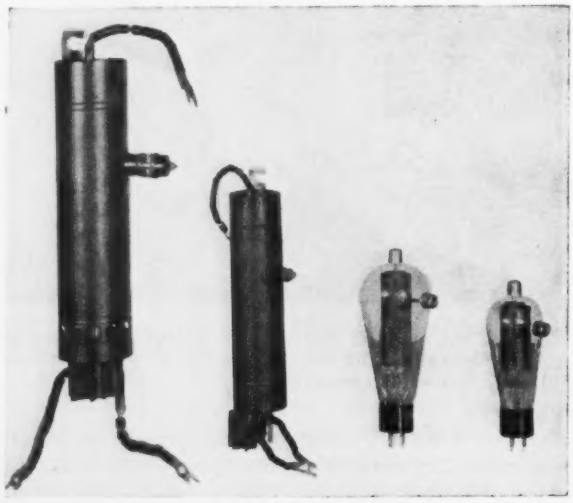


FIG. 5.—Several sizes of industrial thyratrons.

With a direct potential applied to the anode of the tube, the grid will determine the time at which conduction takes place in response to some external signal, but then has no further control effect, and current will continue to flow until it is interrupted by some other means. If an alternating potential is applied to the anode of the tube, the current ceases automatically at the end of each positive half-cycle and the grid, therefore, may regain control after each conduction period. For many applications, it is desirable to vary the output in proportion to a given signal rather than to have a simple off-on device. This is usually accomplished by delaying the instant at which conduction starts and so permitting only a part of the applied voltage wave to be conducted.

One application of interest to the glass industry is the temperature control of annealing furnaces. In this, as in many industrial applications, the electronic tubes function primarily as a control device. There are three main parts in the equipment, viz., a temperature-indicating instrument, a thyratron amplifier, and a saturable reactor. Figure 6 shows the general relationship of the parts. The reactor is placed in the a.-c. power line and transmits power in proportion to the amount of direct current in the saturating winding.

The temperature-control instrument is usually of the recording type and has a control-band width of the order of 10° to 20°F. The control is arranged to change the power input from a minimum to maximum in this small temperature range. As a result, it is extremely sensitive to slight changes in temperature. Figure 7 shows a soaking furnace in the steel industry using this method of temperature control. In the glass industry, it is being used for the annealing of lenses. In this use, the control may be modified to

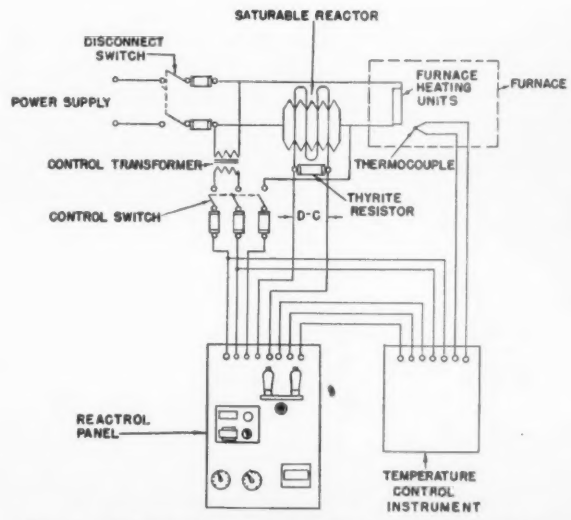


FIG. 6.—Schematic diagram of furnace-temperature control using a saturable reactor and thyratron tubes to regulate the power input to the furnace heaters.

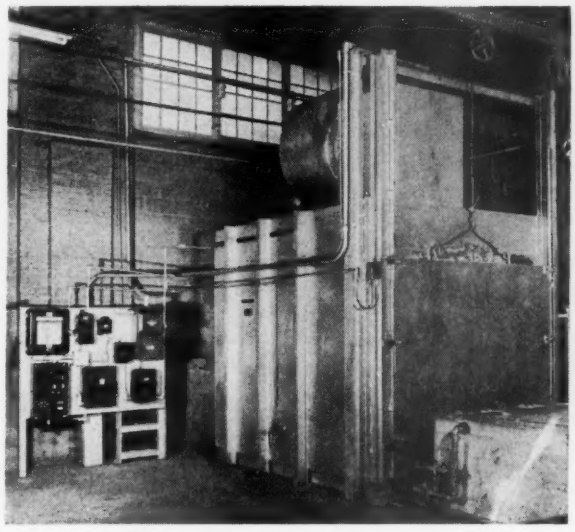


FIG. 7.—A furnace for heat-treating steel equipped with the control shown in Fig. 6.

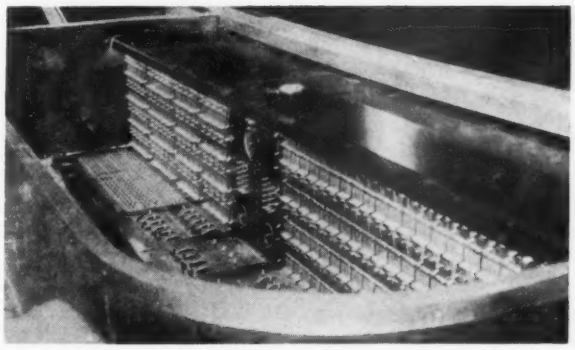


FIG. 8.—The console at the Radio City Theater which controls the lighting through thyratron-saturable reactor equipment similar to that used in the furnace-temperature control.

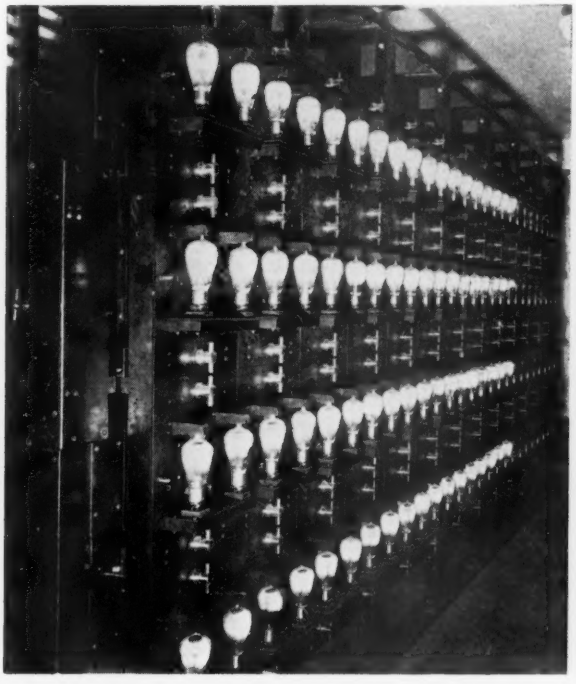


FIG. 9.—Some of the thyratron tubes in the lighting control at the Chicago Civic Opera.

provide the required increase in temperature during the preheating period, to hold constant temperature during the annealing period, and finally to allow the glass to cool at the required rate for minimum stress. In any application of this nature, it is preferable to design the furnace with relatively little insulation and low heat-storage capacity. The temperature may then be controlled by supplying the losses electrically and the desired heating or cooling rates obtained.

Another application of the same general type, but in quite a different field, is shown in Figs. 8 and 9. Figure 8 shows the console at Radio City Theater through which the stage lighting is controlled, and Fig. 9 shows the thyratron tubes and reactor panels at the Chicago Civic Opera.

One of the latest developments using thyratron tubes is the automatic control of motor speed. The thyratron tubes carry the full motor current rather than merely control current. One pair of tubes supplies power to the motor armature and a second pair supplies the motor field. The motor may be adjusted for any desired speed from a few revolutions per minute to maximum, and the speed may be held constant at the chosen setting. The load may vary without a corresponding change in the motor speed. The speed regulation without any attachments to the motor is within plus or minus 2% from no load to full load at any set speed and this may be reduced to plus or minus ½% if a speed indicating pilot generator is added. The speed, of course, may be varied automatically to conform to a required setting, as, for example, to hold a constant cutting speed in a lathe as the tool is moved to larger diameters. Constant acceleration or deceleration, as well as reversal, may be obtained by additional tubes and control.

Figure 10 shows a complete installation attached to a milling machine for finishing airplane spars. In this application, the control is arranged to drive the spar at the required cutting speed through the section to be milled. Then the milling-machine table speed is increased to a maximum until the next section to be milled is reached. At this point, it decelerates to the cutting speed and the cycle starts all over.

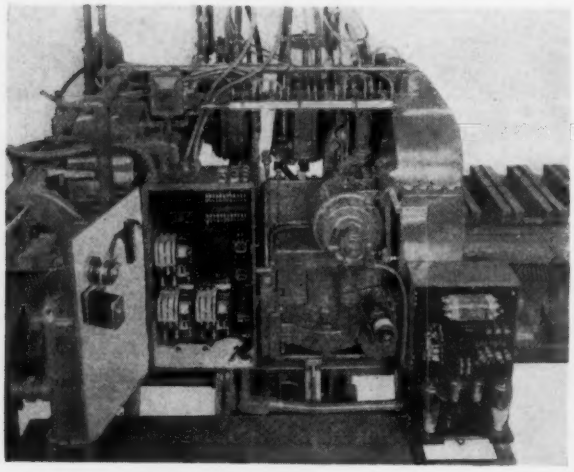


FIG. 10.—A milling machine equipped with electronic motor-speed control (*left, door open*) through which the speed may be held constant with changes in load.

VI. Ignitrons

The ignitrons are mercury-pool tubes, usually water cooled and capable of carrying the currents required in the larger sizes of d.-c. conversion apparatus. The ignitor itself is a small piece of highly refractive material about the size and shape of the pointed section of an ordinary lead pencil. This point dips into the mercury. By passing a current impulse of the order of 10 to 40 amperes through the ignitor, a cathode spot can be established on the pool. As the anode current is increased, the cathode spot divides and subdivides until a sufficient number exists to supply the required current. Variation of the output is obtained in the same manner as in the thyratron by delay of the instant or phase of starting. Arc losses are low, being of the order of 12 to 20 volts.

There are two principal applications:

(1) Resistance-welding control in which the ignitrons act as a switch in the power supply to the welding transformer.

(2) Rectification of alternating current for direct-current power supplies.

In welding service, two ignitron tubes are connected to transmit both the positive and negative portions of the alternating-current wave to the transformer primary. The current range is of the order of 40 to 9000 amperes, and the duration is usually from 1 to 30 cycles. The timing is accomplished by other electronic controls and may be selected to supply one, two, or more cycles as determined by the weld requirements. Once the control is set, the weld cycle may be repeated as many times as desired. The increased accuracy and precision resulting from the ability to control exactly the number of heating cycles accounts for the almost universal acceptance of this control system. Resistance line welding is a series of overlapping spot welds in which the "on" as well as the "off" cycles must be accurately controlled. The final assembly welds of the sealed ignitron tubes are made in this manner. A typical welding machine and control are shown in Fig. 11. This particular machine is used to fabricate aluminum-alloy struts for airplanes.

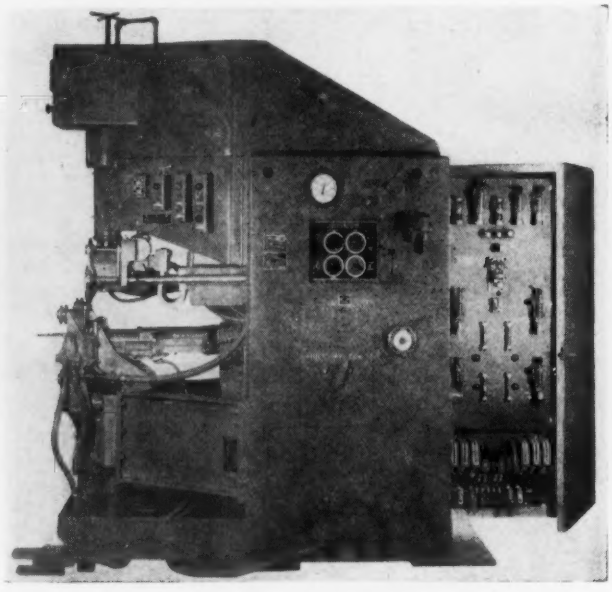


FIG. 11.—Resistance line welding equipment using electronic control. Ignitron tubes carry the primary power.

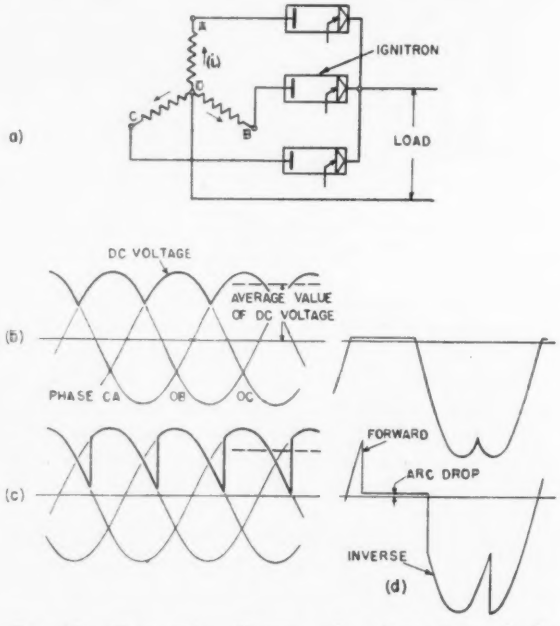


FIG. 12.—Connection diagram of a three-phase single-way rectifier (*a*), output-voltage wave shape, and voltage across rectifier tube (*d*) for fully advanced (*b*) and retarded (*c*) phase conditions.

In industrial service, the ignitron rectifiers are used to supply direct-current loads of 50 to 1000 kilowatts at 250 to 600 volts. When higher capacities are required, rectifiers may be connected in parallel with other rectifiers or conversion equipment.

A simple three-phase single-way rectifier is shown in Fig. 12, together with the output-voltage wave shapes for fully advanced and retarded ignition phasing. The voltage across the ignitron tubes is also shown. Rectification of an alternating current is analogous to the action of a loaded wheel. As the wheel turns, the load is successively carried by the spoke between the axle and ground. As the phases of the rectifier rotate, the load is successively carried by the one whose voltage is higher with respect to the load.

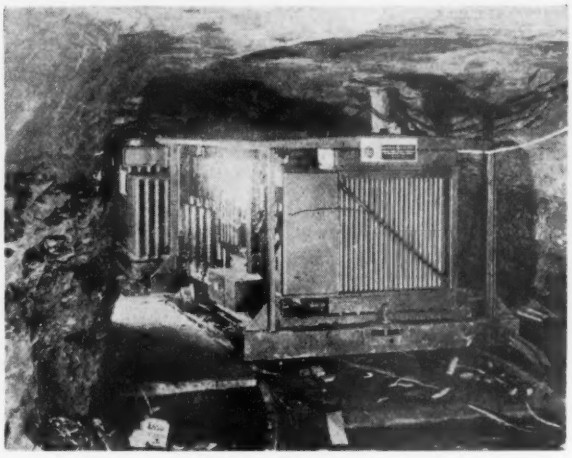


FIG. 13.—Installation of a sealed ignitron rectifier in a mine shaft.

Rectifiers of this type are used to supply direct current for cranes, elevators, motors, lights, and electrolytic processes. Figure 13 shows a movable d.-c. substation for mining service as installed in a lateral near the main shaft. The unit is completely automatic and self-contained. When the coal is mined from one section, the substation is moved to the next working center. A stationary d.-c. unit substation, complete with switchgear, meters, and transformer, is shown in Fig. 14. This unit is supplying power for cranes and motors in a war plant.

One of the outstanding jobs that has been done electronically has been the conversion of alternating current into direct for the electrolytic production of aluminum.

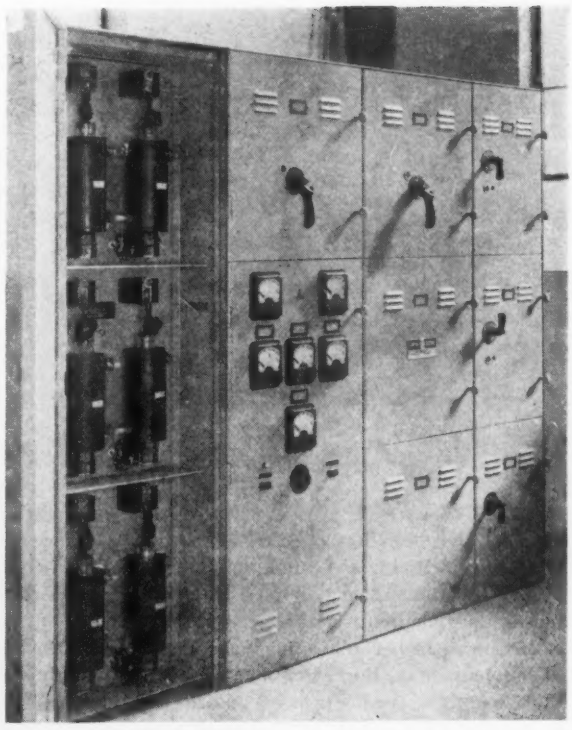


FIG. 14.—An industrial ignitron rectifier supplying d.-c. power for motors in a war plant. Rectifier-compartment door open to show sealed ignitron tubes.

Power equipments are of the order of 30,000 kilowatts at 600 volts d.-c. for a single pot line.

VII. Electron Microscope

One of the newest and most interesting electronic developments which promises to be of considerable aid to industry is the electron microscope. Visible light waves are of such a length that the practicable magnification limit by optical means is of the order of 1000 diameters. Above this magnification, absorption and diffraction tend to cause distortion of the image. The wave length associated with the electron is much shorter and depends on the potential to which it is accelerated. Magnifications to several thousand diameters are quite practical directly and, by further enlargement of the negative, excellent pictures at 10,000 to 20,000 diameters have been made. Figure 15 shows electron guns, accelerating grids, sample mount, lens, and fluorescent viewing screens of an instru-

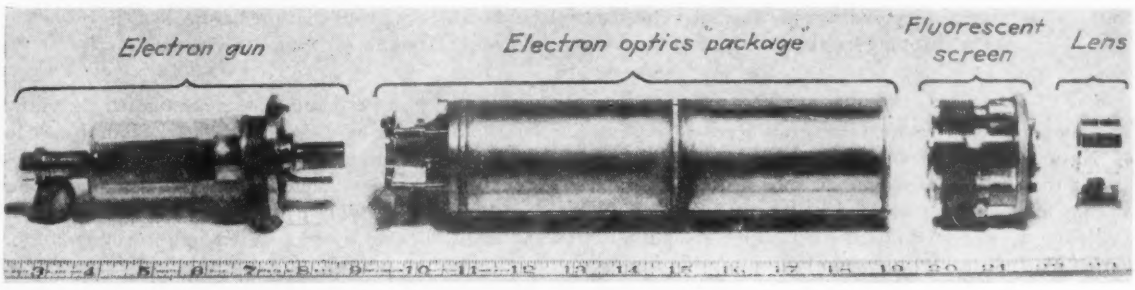


FIG. 15.—Photograph and drawing showing the essential elements of an electron microscope.

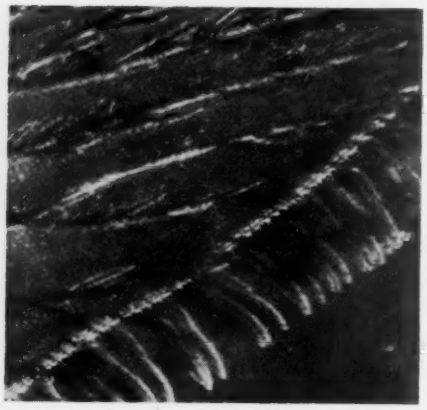


FIG. 16.—Photograph of a mosquito wing magnified 100 times.

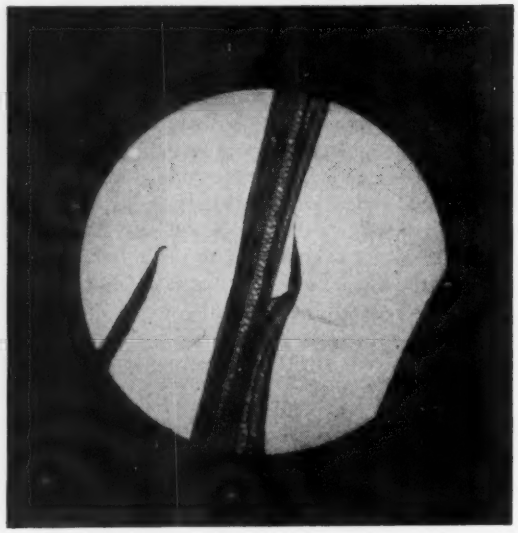


FIG. 17.—One of the "feathers" at the bottom of the mosquito wing (Fig. 16) magnified 2500 times

ment that has been developed for industrial use. The complete unit, including a vacuum pump and all accessories, is designed to provide maximum ease of operation with a practicable magnification range. The lenses are of the electrostatic rather than the magnetic type. Focusing adjustments may, therefore, be made permanently during the assembly of the instrument, and the adjustment is not affected by variation of the supply voltage. The picture is formed on the fluorescent viewing screen and, when desired, photographs are taken of this picture rather than inserting a negative inside the microscope. Figure 16 shows a mosquito wing which has been enlarged 100 diameters by conventional means and Fig. 17 shows one of the small feathers at the bottom of the wing enlarged 2500 diameters in the electron microscope.

The conventional light microscope has been of incalculable aid in almost every branch of human endeavor, and it seems certain that the increased power of the electron microscope will lead to an even better understanding of physical structure.

VIII. Conclusion

There are many ways in which electronics can serve in science, in the home, and in industry. The field of use is constantly growing. Electronics is not, however, a universal solution to all problems. It should be applied in industry where sound engineering judgment dictates that the advantages offer a better, simpler, or less costly solution than other methods.

TUBE DIVISION
ELECTRONICS DEPARTMENT
GENERAL ELECTRIC COMPANY
SCHENECTADY, NEW YORK

EFFECT OF HARDNESS OF HAMMERS ON RESISTANCE OF VITRIFIED CHINAWARE TO CHIPPING AND TO IMPACT *

BY R. F. GELLER AND A. S. CREAMER

ABSTRACT

Thirty dozen 7-in. hotel-weight plates were subjected to chipping and to impact tests using six different chipping hammers and two different impact hammers of varying hardness values. The results show that impact hammers of considerably different hardness will give the same average values for resistance to breakage but that the hardness of the chipping hammer may affect the average values obtained for resistance to chipping.

I. Introduction

A manufacturer of vitrified chinaware recently requested the National Bureau of Standards for information regarding the effect, if any, of variations in the hardness of chipping hammers on the apparent resistance of such ware to chipping when tested in accordance with Federal Specification M–C–301a. The Bureau had been using the same hammer for years and had never investigated the effect of variations in the hardness of the steel, and the Federal specification required only that the hammer be made of steel. A study was therefore undertaken using steel hammers of widely varying hardness; the manufacturer who had made the inquiry cooperated by furnishing 30 dozen 7-in. (trade-size) plates. Advantage was taken of this opportunity to study also the effect of steel hardness on the resistance of plates to impact.

*Received September 7, 1943.

II. Materials and Methods

All of the plates were made of the same body and glaze, presumably under identical manufacturing procedure, and were designed to conform to the 7-in. rolled-edge (RE) hotel-weight china plate described in paragraph E–4a of specification M–C–301a. For 168 plates, the diameter ranged from $8^{15}/_{16}$ to $9^{1}/_{8}$ in. and averaged $9^{1}/_{32}$ in. The weight for 336 plates ranged from $22^{3}/_{4}$ to 27 oz. and averaged $24^{3}/_{8}$ oz.

Five new 6-oz. chipping hammers and one new 4-oz. impact hammer were made, conforming in shape to the hammers shown in the Federal specification. They are described in Table I. The heat-treatments were made in the Metallurgy Division of the National Bureau of Standards.

TABLE I

HEAT-TREATMENT AND HARDNESS OF HAMMERS*

Hammer No.	Type	Tempering treatment (°F.)‡	Hardness		
			Vicker's (Vn_{30})	Rockwell (B)	Rockwell (C)
1	Chipping	§	160	79	
2	"	900	375		40
6	"	725	470		47
5	"	500	650		58
3†	"	(Unknown)	655		57
4	"	400	720		61
8†	Impact	(Unknown)	210	94	
7	"	500	665		

* The new hammers were made of tool steel containing C 0.88, Mn 0.25, Si 0.12, P 0.013, S 0.009, Cr 0.08, and Ni 0.10%. The tempering treatment followed a hardening treatment made by holding the hammers at 1450° F. for $^{1}/_{2}$ hour and quenching in brine.

† Old hammer which had been in use for several years. The old chipping hammer is 0.453 in. wide with the chipping face finished on a 0.25-in. radius. The new hammers are 0.562 in. wide, and the radius of the chipping face is 0.379 in.

‡ Held in the furnace at this temperature for 1 hour and then cooled in air.

§ Annealed only.

The chipping and impact tests and the water absorption determinations were made as described in the Federal specification, except that the impact tests were made on plates which had previously been chipped.

III. Results

The values for resistance to chipping and to impact obtained with the various hammers described in Table I are summarized in Table II. Hammer No. 1, made of the untreated steel, was so soft that it deformed readily at the point of impact, and repeated blows from the maximum point on the scale of the impact apparatus (0.75 ft.-lb.) failed to chip the plates. Hammer No. 2 seems to be at the borderline between hammers which are too soft and those which are usable. During the tests on 58 plates, the face became marred but not enough to affect materially the results obtained with this hammer.

Calculations show that the differences in average chipping value obtained with hammer No. 2, compared with hammers Nos. 3, 4, 5, and 6, are highly significant for both plate averages and individual values. The same is true of the differences between values obtained with hammer No. 4 and hammers Nos. 3, 5, and 6. The differences in values obtained with hammers Nos. 3, 5, and 6 are, however, not significant, which shows that the Vicker's hardness number for the chipping hammer can range from 470 to 655 without affecting the result unduly.

The new hammer No. 5 was intentionally tempered to approximately the same hardness as the old hammer No. 3 to ascertain the difference the radius of the impact face might have on the results. As shown in Table II, the values obtained with the one were practically duplicates of those obtained with the other.

The old impact hammer (No. 8) had evidently had a very mild heat-treatment as it was but slightly harder than hammer No. 1. During the course of the years, it had become somewhat deformed at the edges through mishandling, but it was still serviceable. The new hammer was tempered to approximate hammers Nos. 3 and 5 in hardness. Although the difference in hardness of the impact hammers is considerable, the average values for resistance to impact are practically duplicates, which indicates, therefore, that the hardness of the hammers used is not a factor in the impact test.

Although the preceding observations and conclusions cover the information that this study was originally designed to obtain, a number of other interesting points can be developed from the data. For example, is there any correlation between variations in absorption (as a measure of thermal history) and resistance to chipping or to impact? Absorptions were determined on 48 plates which represented extremes in resistance to chipping and to impact. The results show no consistent relation between

TABLE II

VALUES FOR RESISTANCE TO CHIPPING AND TO IMPACT (HAMMERS DESCRIBED IN TABLE I)

Hammer No.	Vicker's hardness	Chipping test						Impact test	
		Values (No.)	Plate averages (ft.-lb.)‡	Values (No.)	Individual chips (ft.-lb.)‡	Top chips (%)	Bottom chips (%)	Plates (No.)	Impact to break (ft.-lb.)‡
1*	160			2	>0.75				
2†	375	55	0.29 ± 0.03	166	0.29 ± 0.04	72	28		
6	470	54	0.26 ± 0.02	220	0.26 ± 0.03	63	37		
5-1	650	54	0.27 ± 0.03	217	0.27 ± 0.04	94	6		
5-2	650	54	0.27 ± 0.04	214	0.27 ± 0.05	86	14		
3	655	56	0.26 ± 0.03	168	0.26 ± 0.04	71	29		
4	720	56	0.23 ± 0.02	168	0.23 ± 0.03	71	29		
7	665							78	0.39 ± 0.05
8	210							86	0.38 ± 0.05

* Too soft for use, deforming readily at point of impact.

† Showed slight deformation at point of impact after completion of tests.

‡ The ± values are standard deviations.

variations in absorption and mechanical strength for the plates tested.

A similar comparison was made for extremes in chipping values and weights. Although, as noted in Section II, the weights of the plates ranged from $22^3/_4$ to 27 oz., actually only a small percentage weighed less than $23^3/_4$ or more than $24^3/_4$ oz. The average weight of a dozen plates showing highest resistance to chipping was practically the same as the weight of a dozen plates showing lowest resistance.

Other questions often asked are: "Why do some plates chip out at the top surface while others, apparently of identical design, chip out on the bottom?" and "Do plates which chip on top when tested in the laboratory also chip on top in service (or vice versa)?"

There is no information available to the authors on which to base an answer to the second question, but an attempt was made to answer the first. Table II gives the relative number of top and of bottom chips obtained in this study. When the 5-1 series of tests with hammer No. 5 produced 94% of top chips whereas the other hammers

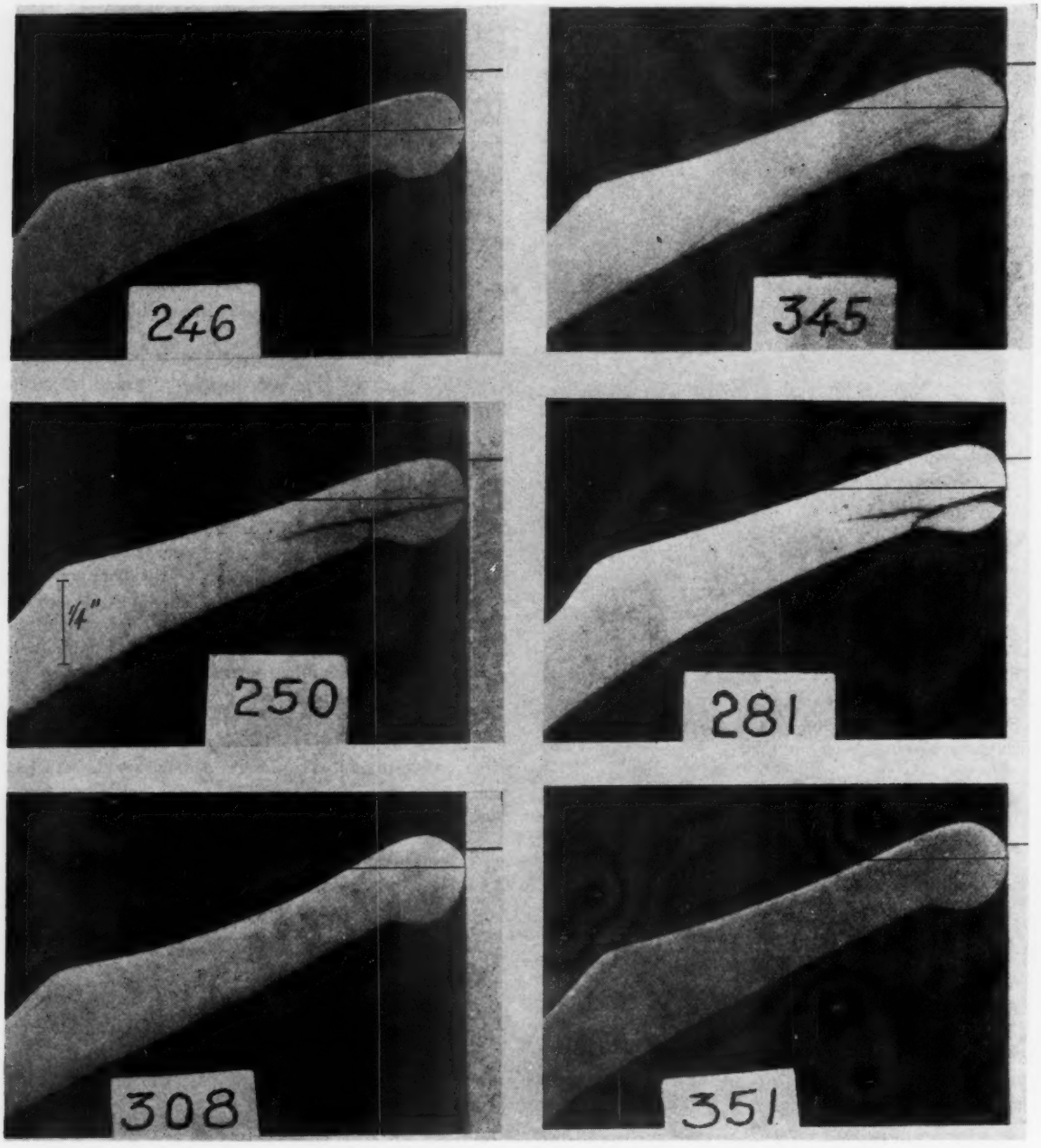


FIG. 2.—Sections of plates. Horizontal line on white surface at right of each plate edge is 1 in. above base. Plates 246 and 345 chipped on the bottom, plates 308 and 351 chipped on top, and plates 250 and 281 broke away in small chips at both top and bottom surfaces.

had produced less than 75%, the hammer was examined. It was found that the hammer had been fastened to the steel tape so that the impact face "sloped back" from the test plate, making an angle of 2° with the vertical at the time of impact. This produced an upward component in the blow which, although almost immeasurably small, was sufficient to raise materially the ratio of top to bottom chips. The situation was corrected and the 5-2 series of tests (Table II) were made. The conclusion is that in a study of edge contour and its effect on top and bottom chipping care must be exercised to have the chipping face of the hammer perpendicular to the direction of motion.

Although the plates tested were all of the same design, there was some variation in the slopes of the rims and consequently in the height of the plate edge above the base. It seemed logical to expect relatively more bottom chips on the flatter rims. To test this theory, the height of the edge on each of 112 plates was measured before the chipping tests, and the tests were then made on each plate where its rim was of maximum height and where it was of minimum height. The result, plotted in Fig. 1, shows that

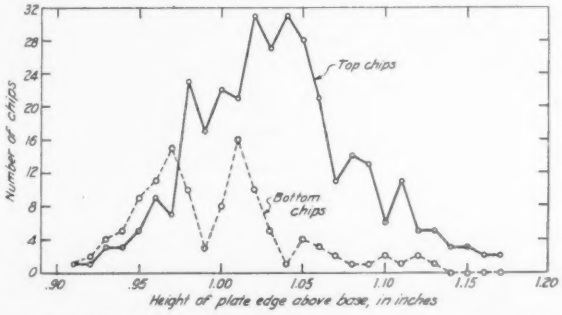


FIG. 1.—Effect of height of plate rim above base on relative number of top and bottom chips.

the number of bottom chips exceeded the number of top chips for those tests made at points where the edge of the plate was less than 0.98 in. above the base.

As an additional study of plate design, particularly the contour of the edge, and its possible relation to chipping, twelve sections were cut from several plates perpendicular to the edge and next to the chipped areas. For purposes of comparison, these sections were photographed to give enlarged images. Six typical sections are shown in Fig. 2 (see opposite page), and the enlargement of the prints as published may be judged by the scale shown on plate section No. 250. Each plate edge is shown in contact with a light surface on which there is a horizontal line. This line was one inch above the base on which the plates rested and may be used as a reference for observing the relative heights of the plate rims. The edge of the light surface was perpendicular to the base and therefore represents the position of the hammer at the moment of contact and shows the point of contact with the plate.

The sections shown in Fig. 2 illustrate plates which chipped in a particular way. Plates 246 and 345 chipped on the bottom; plates 308 and 351 chipped on top; and plates 250 and 281 broke away in small chips at both top and bottom surfaces, the principal failure extending into the plate as shown. A horizontal line has been drawn across each plate section from the point at which the chipping hammer would have struck the rim, and the lengths of these lines show what might be described as the relative thickness of plate along the principal line of force from the hammer blow. Plate 308, for example, was only two-thirds as "thick" as plate 246. For the 12 sections this thickness was least for the 4 plates subject to "top chipping" and is apparently a characteristic difference in shape distinguishing these plates from those chipping either on the bottom or "at the center" (plates 250 and 281). This decreased thickness is more pronounced for plates such as No. 308 having a concave upper rim surface. The plates which failed by center chipping were, on the average, the most resistant to failure.

IV. Summary

A total of 30 dozen 7-in. hotel-weight rolled-edge plates were subjected to chipping and to impact tests using six tool steel chipping hammers, and two impact hammers, representing a considerable range in hardness which, expressed in terms of the Vicker's number, extended from 160 for the untempered steel to 720 for the hardest.

The results show that hammers varying in hardness from 470 to 655 are not damaged in the test and produce chipping values that do not differ significantly. For results which can be duplicated in different laboratories, the Federal specification should require a hammer hardened and tempered to a Vicker's number within this range.

Although the impact hammers had hardness numbers of 210 and 665, respectively, the results obtained with them were practically duplicates and an impact hammer with a hardness in this range would be satisfactory.

Neither variations in water absorption nor in weight affected the chipping or the impact values of the plates tested. The absorption values ranged from 0.00 to 0.19%.

The highest percentages of bottom chips were produced on plates having the least slope of the rim and consequently the least height from the base to the edge. Of 12 sections examined, those taken next to bottom chips also showed a materially greater horizontal distance from the point of impact on the edge through the body to the upper surface of the rim.

NATIONAL BUREAU OF STANDARDS
WASHINGTON, D. C.

Conscientious Objections or
Conscientious Willingness
To Follow Prescribed Educational Schedules

• • •

Which Makes the Best Soldier and Professional?

• • •

Train the Youth Not by His Conscientious Will
But by Rule Proved by Experience

PEASANT POTTERS OF BEAUCE*

A New Road to Rural Reconstruction

By Oscar Bériau

Abstract

A detailed description is given of an unusual Government project in the County of Beauce, Province of Quebec. The sons of farmers are established on small farms and given training in agriculture, carpentry, drawing, modeling, and pottery. The boys are farmers in summer and potters in winter. They raise their own food, build their own furniture, and make pottery supply their cash income.

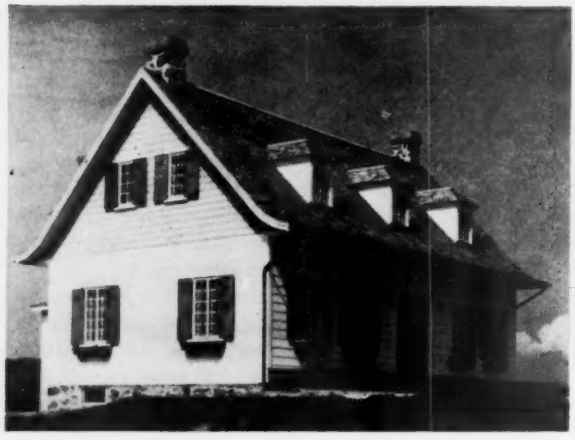
I. Rural Life in the Old Days

During the past ten years, a great change for the better has taken place in the farmhomes of Quebec, which, in the old old days, were almost self-sufficient. In addition to producing crops and livestock, every homestead was a busy workshop for the men and a busy place for handicrafts for the women. Happiness, joy, and contentment reigned over the countryside; the men sang as they tilled the soil and tended their herds and flocks and the women crooned to their babies as they performed their household tasks. The hum of the spinning wheel and the soft clank-clank of the weaving loom was heard in every home. The farm men and women and children were clothed in warm, honest homespun of pure good virgin wool made by the loving hands of the farm women and girls.

The interiors of the farmhomes were gay with the beautiful work of the women's hands: blankets, rugs, wall decorations, and curtains, all in bright cheerful colors and with designs which expressed the countryside and the feelings and emotions, the hopes and aspirations, the love and affections of the women and girls. All the good honest clothing and home equipment and decorations were made from the wool of the sheep and the flax from the fields grown on each farm itself, so that the cost of all these useful and beautiful things was trivial. They were, in fact, simply the products of loving hearts, of honest labor, and of skilled hands.

II. Arrival of Machine Age

For many years, this happy rural life continued, but then a great and sad change took place. The machine age arrived; great industries were started in the cities; and the young people were lured to the bright lights and to the superficial shallow enjoyments of city life. The good farmhome with its typically rural atmosphere began to be merely a cheap imitation of a city home. The handiwork of the farm made from honest good-quality farm-grown materials was thrown away or sold and replaced by factory goods.



The roadside shop on the Portland-Quebec highway

Carving the raw clay

III. Need for Rural Reconstruction

A few years ago, some thought this whole scheme of things was simply no good. Something had to be done to restore to the farmhome and to rural life the dignity, the

* Presented at the Forty-Fifth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 21, 1943 (Art Division). Received April 21, 1943.

Oscar Bériau, F.C.I.C., is a member of the Canadian Institute of Chemistry and the Canadian Chemical Association and a past-president of the Chemical Society of Quebec. He founded the Quebec School of Handicrafts in 1930. In 1938 he trained leaders for New Brunswick and in 1939 for Newfoundland, St.-Pierre et Miquelon, and Clark City. He prepared the plan and program for the Searle weaving project in Alberta and Saskatchewan in 1941 and is actually Director of Handicrafts for the Province of Quebec.

His books include La Teinturerie Domestique (Home Dyeing), Le Tissage Domestique (Home Weaving), and Le Métier à Quatre Lames (The Four-Harness Loom).

nobility, and the quiet contentment and happiness it once had enjoyed.

They began in Quebec to preach the gospel of making the farmhome more self-sufficient, as it had been in the old days. It was demonstrated that things made on the farm by the skilled hands of the farmer and his wife and young people out of the raw materials the farm was producing were not only as good as anything city factories could produce but, in fact, were very much better—the clothing warmer, the rugs longer wearing, the curtains and hangings and wall decorations much more durable and beautiful. These articles were cheaper, too, than city goods of inferior quality.

Turning pottery

Instructors were trained to teach the young farm women how to weave on the hand loom. The project was most successful; after eleven years of this work, there are now 60,000 looms on the farms of Quebec and 100,000 spinning wheels. The farmhomes are once again filled with good honest fine-quality materials on the floors, tables, and walls, and the people are once again clothed in homespun materials of excellent design and of good modern style.

The women were equal to their task and are now doing their share in the war effort; they are grouped into eight hundred clubs called Cercles de Fermières.

IV. Place of Farmers' Sons in Reconstruction Movement

In 1933, it was realized that something had to be done for the boys. With the continued depression, city employment decreased and the establishment of farmers' sons became a serious problem. In normal times, the problem was easily solved; although the French Canadian families were large, the parents were able to give their sons a good start in life. The older boy generally took over the farm and cared for the parents when they were unable to carry on and exploit their land. The father purchased for a second son a lot in a nearby community and the other boys attended the grammar school, high school, and, if possible, a university and went to the city to practice a trade or profession. But the growing depression closed all city avenues to rural boys, and the farmers, owing to the low prices of their produce, were no longer able to buy farms or to pay for higher education.

V. Beauce Project Launched

After a long study of the problem, the conclusion was reached that if it were possible to make the farm almost self-sufficient a family could live on a much smaller acreage, especially if a productive craft were added to farming.

A new plan was decided upon, that of establishing farmers' sons on ten-acre lots on which they would build their homes, workshops, small barns, and poultry houses. Their farming would comprise market gardening, poultry raising, apiculture, and fruit and berry growing.

The Beauce project was launched to train twenty boys in the art of pottery. Beauce was selected, because in this region there are huge deposits of fine clay.

For three years, these boys, during winter months have studied French, English, mathematics, drawing,

Modeling

modeling, carpentry, and pottery. During the summer months, they have practiced agriculture.

Woodwork was added to their curriculum so they would be able to build their own cottages and make their furniture and any equipment required for the farm and workshop. The students have already begun to make their furniture as well as a weaving loom to be given to their brides-to-be.

Parents have agreed to give their sons the ten acres of land and the lumber necessary to build the houses and workshops as well as to make all the furniture. These homes will be built according to plans supplied by the Government and will be in proper setting with the environment and in accordance with the traditions of French Canada.

The Government will also provide the services of experts for the building of the homes and workshops. These experts will include architects, masons, carpenters, electricians, plumbers, painters, and a landscape architect.

The group is organized under a cooperative system and already owns an experimental workshop built on the main highway between Portland and Quebec. This building will also be used as their roadside shop.

Each artisan will have his own studio, potter's wheel, molds, kiln, and accessories. The students have learned the secrets of their craft under the direction of Wellie Chochard, a graduate of Fribourg, Switzerland, and of Raymond Lewis, a graduate of the School of Fine Arts of Montreal.

The courses in woodwork are under the direction of Brother Ignace, director of manual training at Beauceville

College. The demonstrations in agriculture are under the direction of J. W. Marceau, local agronomist.

The peasant ceramists of Beauce will be ready to offer their ware to market during the present year, and the trade, waiting the results of this project, is hoping to buy large quantities of goods from the syndicate. Traders have been warned that this project is not a mass-production venture and that agriculture must be the main occupation of the boys; pottery is only a supplement to occupy the winter months and provide an additional revenue.

A Canadian design

This plan will serve as an experiment and, if it proves to be a success, will be duplicated in several parts of the Province, where other crafts will be added to agriculture, according to the supply of raw material available in each section.

VI. Educational and Moral Value of Movement

The economic aspect of this movement cannot be overlooked, but of greater importance are the educational and moral values. During the winter months in Eastern Canada, the leisure hours are long and the recreations are few. But in practicing his trade, the potter may spend his days in a pleasant and productive occupation and find the cultural satisfaction which comes through knowing and doing. This double advantage cannot be too highly esteemed.

The little cottages of Beauce will be beautified by the production of ceramic ornaments and decorations. The craftsman will not sell his whole production; he will keep for himself not only the useful articles needed for his homestead but also some of his best pieces, which will bear testimony of his skill and will bring, by their rural character, a note of individuality to his home.

By a practical method of teaching, the craftsman will learn to develop a keen sense of observation, he will cultivate his taste, his craft will be influenced by the rural

Majolica glaze

atmosphere, his traditions, and his temperament, and these influences will help to create new forms.

Is he not privileged, this young farmer-craftsman, to face life fully trained and equipped, when so many boys can depend only on their preliminary education, courage, and physical strength?

The Government of Quebec, in promoting this youth-training plan, is accomplishing a great thing, which can be described in the following words: "La main et le métier ne valent que s'ils sont au service de l'esprit" (The hand and the trade are of value only if they serve the mind).

Department of Agriculture
Quebec, Canada

OCCUPATIONAL THERAPY*

By Helen S. Willard

Abstract

The modern use of occupational therapy is emphasized as it is administered by the trained technician under medical supervision. The development of the profession, its aims, training required, various phases of application, relationship to the fields of medicine, psychology, and sociology, and its place in the present emergency and future rehabilitation are discussed.

I. Development and Aims

Alice in Wonderland nibbled a cookie and suddenly found herself grown enormously tall. Occupational therapists have a fellow feeling for Alice. For twenty-five years this profession has been developing. Now, almost overnight, much interest has been focused upon occupational therapy because it deals primarily with the restoration to normal of persons who are sick or injured. We all envision the days of reconstruction which must come after this war and realize that occupational therapy must inevitably play a large part in it. Articles on the subject are appearing more and more frequently in newspapers and magazines. Movies such as "Private Worlds" and "Now, Voyager" have shown glimpses of it, and books which mention it are growing in number.

In World War I, far-sighted doctors, realizing the need of helping injured soldiers to readjust their lives, inaugurated in the Office of the Surgeon General of the Army a corps known as Reconstruction Aides in Occupational Therapy. The members were recruited for the most part from the ranks of artists and persons who were skilled in manual activities. A few were given three- to four-month training courses which consisted mostly of lessons in craft work and some lectures on medical subjects. Many, however, were taken directly from art schools or from positions as teachers of industrial arts. The basic soundness of the underlying principle of occupational therapy, namely, that mankind must be constructively employed to be well and happy, was amply demonstrated by the results which were achieved.

The schools of occupational therapy which were started in 1918 were called upon to develop their curricula to provide persons qualified to use the widest possible variety of occupations with a thorough understanding of the proper application of varied activities to the specific needs of the patient. An accredited school of occupational therapy must now meet standards set by the American Medical Association. The American Occupational Therapy Association, located at 175 Fifth Avenue, New York City, maintains a register of qualified occupational therapists. Twelve schools are fully accredited and seven others, which have been opened recently, meet the required standards in the organization of their courses.

II. Required Training

An applicant at the present time must have at least one year of post high-school education to qualify for admission to the three-year course of an accredited school of occupational therapy. A graduate of college, normal, or art school may be given sufficient advanced standing so that the course may be completed in sixteen months (eight months of theoretical training and eight months of clinical practice). Most of the schools are affiliated with institutions of higher learning, and students who so desire may attain a college degree at the same time that they are specializing in occupational therapy. Such courses require five years of study. The occupational therapist, therefore, has training comparable in length to that of the student of fine arts or the art teacher and with much of the same content, but with a totally different emphasis upon the methods of use of their similar tools. Furthermore, in the selection and preparation of the student therapist, emphasis has been laid upon the personality traits necessary in one who is to work successfully with sick and disabled persons.

In the treatment of mental diseases, a foundation of normal and abnormal psychology and knowledge of psychoses, plus at least three months of training in a mental hospital, prepares the occupational therapist to work in close association with the psychiatrist in the treatment of his patients.

The occupational therapist is in a unique position in that the personal equation of the patient so alters the effect of the treatment that one cannot proceed by any hard and fast rule. The patient's interest must be caught and held. Tact, imagination, and initiative must be used to stimulate the patient to accomplishments which will assist him in stabilization and readjustment.

The skills which the occupational therapist brings to bear upon the problem vary from the fine arts, drawing, painting, sculpture, music, or dramatics to varied crafts, gardening, printing, dressmaking, or social recreation. No one person can be adept in all of these skills, but the trained occupational therapist knows and understands their uses.

III. Phases of Application and Relation to Medicine, Psychology, and Sociology

John, a soldier suffering from deep depression, was referred for occupational therapy. He had so withdrawn into his own world of unreality that he had to be lifted out of bed, dressed like a child, and led into the ward sitting room. He would not reply when spoken to and reacted only enough to turn his chair so that he faced into a corner and then closed his eyes and covered his ears with both hands. There he would sit motionless unless he was forced to move. The therapist tried to show him work which the other men were doing but elicited no response until she placed a ball of clay between his hands and started him rolling it. He continued rolling automatically until it

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disintegrated. This was repeated until the day came when he reached out for the clay of his own accord. Then he began to mold it and at last to shape it into the form of a cross, the symbol of a sense of guilt and the fear which he believed had branded him a coward in the eyes of his comrades and officers. Large and small crosses grew under his fingers but, as his skill increased, he was persuaded to try other forms. He finally developed intense interest in modeling, became one of the most adept workers in the pottery shop, and regained a normal attitude toward life which enabled him to leave the hospital and to carry on successfully in his previous job in a printing office. Modeling remained to him as an absorbing avocation in which he sought refuge and change.

The trained occupational therapist works with physically injured persons only after being thoroughly grounded in anatomy and physiology, muscle function, neurology, orthopedics, and the theory of occupational therapy in the treatment of fractures, sprains, strains, dislocations, burns, lacerations, paralyses, and other crippling conditions. The patient may quite unwittingly substitute uninjured muscles and joints for those which should be exercised and a person unversed in this particular use of manual occupations may injure rather than help the patient by exercising muscles already too strong for their weakened opponents. It is obvious, therefore, that such treatment can safely be directed only by persons thoroughly trained in its application.

There is a wide range of use for occupational therapy in the treatment of children. Here the occupational therapist's basic knowledge of psychology and the mental and motor development of the child enables her to adapt activities to the age and ability of small patients. Many of the difficulties of maladjusted children may be overcome by the well-trained therapist working in close collaboration with teachers and social workers.

The treatment of the blind again calls for specialized knowledge and training on the part of the therapist. The problem here may be one of education for children blinded from birth in whose training manual skills play a considerable part, or it may be the readjustment of the newly blinded person. The major part which occupational therapy plays is with the adult in bridging the gap from the moment that full realization of the catastrophe of blindness comes to the beginning of specific rehabilitation.

The broad field of occupational therapy used as diversion is perhaps the last of the types to be considered. Extensive use may be made of the volunteer in caring for children for whom simple crafts, storytelling, games, and similar activities are indicated, individually or in groups. With adults again a wide variety of recreational and diversional activities may be used. So long, however, as the individual is a patient, there should be careful supervision of such a program, and only those volunteers who thoroughly understand their particular function should be permitted independent care of patients.

IV. Place in Present Emergency

The Army is at the present time planning to open one hundred and seventy-five occupational therapy departments in base and station hospitals. Departments already established have from two to five therapists and are enlarging rapidly. The primary purpose of the Army hospital is to return the men to active service or to remunerative occupation as soon as possible.

The Navy also is using occupational therapy in its hospitals and has given commissions in the Women's Naval Reserve to therapists who will head the departments. The persons employed are graduates of accredited training schools.

The accredited schools af occupational therapy are being asked to train more than 600 persons per year to meet the need. The schools have not only accelerated their programs but are planning special emergency courses which will provide adequately trained workers to cope with the tremendous problem of rehabilitation which faces us both now and after the war. Occupational therapy is finally achieving wide recognition as a valuable and necessary means of restoring sick and disabled individuals to active and useful lives.

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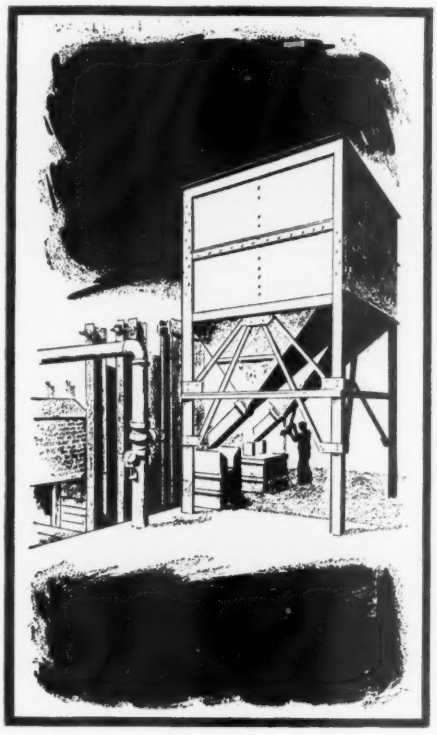

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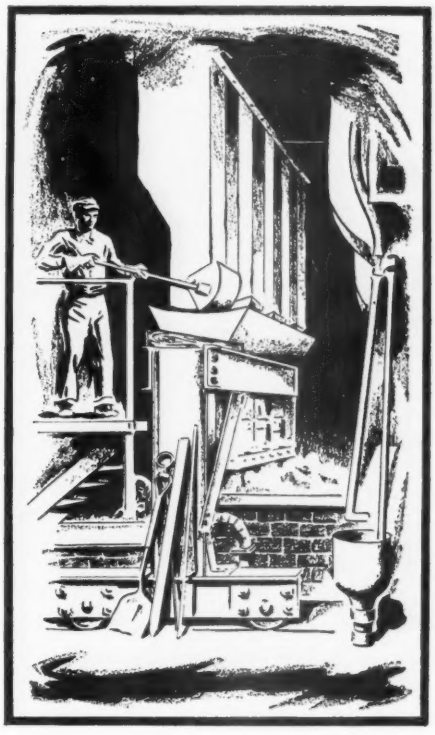

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Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Enamels
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Pemco Corp.
The Vitro Mfg. Co.

Enamel Oxide
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.

Enamels (Porcelain)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Pemco Corp.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Engineering Service
Chicago Vitreous Enamel Product Co.
Harrop Ceramic Service Co.

Equipment (Porcelain Enameling)
Chicago Vitreous Enamel Product Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.

Feldspar
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Eureka Flint & Spar Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Maxson, Elwyn L.
Pemco Corp.
Pennsylvania Pulverizing Co.
The Vitro Mfg. Co.

Filter Fabrics
Metakloth Company

Fire Brick
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Green, A. P., Fire Brick Co.
Norton Co.
Taylor, Charles, Sons Co.

Fire Brick—Process Equipment
Lancaster Iron Works, Inc.

Fire Clay
Great Lakes Foundry Sand Co.
Spinks, H. C., Clay Co.
Taylor, Charles, Sons Co.

Flint
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Great Lakes Foundry Sand Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Pemco Corp.
Pennsylvania Pulverizing Co.

Flint Pebbles
Ceramic Color & Chemical Mfg. Co.
Eureka Flint & Spar Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
The Vitro Mfg. Co.

Floors (Non-Slip)
Norton Co.

Fluorspar
Ceramic Color & Chemical Mfg. Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

French Flint
Eureka Flint & Spar Co.
Maxson, Elwyn L.

Frit
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Pemco Corp.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Frosting Mixtures
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Fuel Oil Systems and Control Stokers
Frazier-Simplex, Inc.
Harrop Ceramic Service Co.

Furnaces
Carborundum Co. (*Carboradient*)
Frazier-Simplex, Inc.
Harrop Ceramic Service Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana Inc.
Swindell-Dressler Corp.

Furnaces, Enameling
Swindell-Dressler Corp.

Gauges, Draft (Recording, Indicating)
Hays Corp.
Leeds & Northrup Co.

Gauges, Flow (Air and Gas)
Hays Corp.

Gauges, Pressure
Hays Corp.
Leeds & Northrup Co.

Gauges, Ratio (Flows)
Hays Corp.

Glass Bending Ovens, Glass Decorating Machines
Frazier-Simplex, Inc.

Glass Equipment
Lancaster Iron Works, Inc.

Glass Melting Tanks and Furnaces
Frazier-Simplex, Inc.

Glass Sand
Great Lakes Foundry Sand Co.

Glass Thickness Gauge
Bausch & Lomb Optical Co.

Glaze and Body Spar
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Eureka Flint & Spar Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
Pemco Corp.
The Vitro Mfg. Co.

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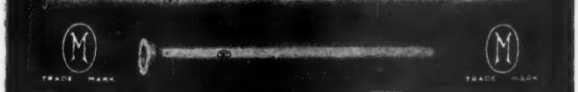

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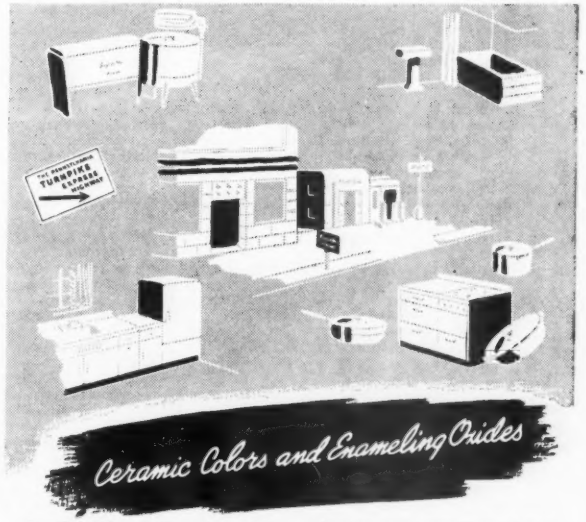

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Ingram-Richardson Mfg. Co. of Indiana, Inc.
Pemco Corp.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Glaze Spar
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Eureka Flint & Spar Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.

Goggles
The Hommel, O., Co., Inc.

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Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Gold Decorations
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.

Granulators
Lancaster Iron Works, Inc.

Grinding Wheels
Carborundum Co. (*Carborundum and Aloxite*)
Chicago Vitreous Enamel Product Co.
Electro Refractories & Alloys Corp.
Norton Co. (*Alundum-Crystolon*)

Hearths
Carborundum Co. (*Carbofrax* heat treating)
Corhart Refractories Co.
Norton Co. (*Crystolon*)

Hearths (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Norton Co.
Taylor, Charles, Sons Co.

Hydraulic Propellers
Denison Engineering Co.

Hydrofluoric Acid
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Ilmenite
Orefraction, Inc.

Iron Chromite
Harshaw Chemical Co.

Iron (Enameling)
American Rolling Mill Co.

Iron Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pemco Corp.
The Vitro Mfg. Co.

Kaolin
Ceramic Color & Chemical Mfg. Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
United Clay Mining Co.
The Vitro Mfg. Co.

Kilns, China (Decorating)
Drakenfeld, B. F., & Co.
Frazier-Simplex, Inc.
Harrop Ceramic Service Co.
The Hommel, O., Co., Inc.
Swindell-Dressler Corp.

Kilns (Electric, Circular, Tunnel)
Ferro Enamel Corp.
Harrop Ceramic Service Co.
Swindell-Dressler Corp.

Kiln Furniture (Silicon Carbide, Semi-Silicon Carbide) (Refractory)
Carborundum Co.
Electro Refractories & Alloys Corp.
Ferro Enamel Corp.
Taylor, Charles, Sons Co.

Kryolith (see Cryolite)
Pennsylvania Salt Mfg. Co.

Laboratory Ware
Norton Co.

Lehr Tile (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Electro Refractories & Alloys Corp.

Lehrs
Frazier-Simplex, Inc.
Swindell-Dressler Corp.

Lehrs (Electric or Fuel Heated)
Frazier-Simplex, Inc.
Swindell-Dressler Corp.

Lehr Loaders
Frazier-Simplex, Inc.

Linings (Furnace Refractory, Block Refractory Plate, Brick, and Tile)
Carborundum Co.
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Green, A. P., Fire Brick Co.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Norton Co.
Taylor, Charles, Sons Co.
The Vitro Mfg. Co.

Lithium Carbonate
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Foote Mineral Co.

Lithium Minerals
Foote Mineral Co.

Locomotives
Brookville Locomotive Works

Magnesia (Fused)
Electro Refractories & Alloys Corp.
Norton Co.

Magnesia (Sintered, Calcined)
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pemco Corp.

Magnesite
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Magnesite Calcined
Ceramic Color & Chemical Mfg. Co.
Foote Mineral Co.
The Hommel, O., Co., Inc.

Magnesium Carbonate
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Manganese
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Manganese Dioxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Foote Mineral Co.

Manganese (Oxide)
Ceramic Color & Chemical Mfg. Co.
Corhart Refractories Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Masks (Breathing)
Drakenfeld, B. F., & Co.

Material Handling Equipment (Raw and Finished)
Clark Tructractor

Metals (Porcelain Enameling)
American Rolling Mill Co.

Micronized Products
Pemco Corp.

Microscopes (Polarizing)
Bausch & Lomb Optical Co.
Spencer Lens Co.

Microscopes (Stereoscopic)
Bausch & Lomb Optical Co.
Spencer Lens Co.

Minerals
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Orefraction, Inc.
The Vitro Mfg. Co.

Mixers
Clearfield Machine Co.

Mixers (Batch)
Clearfield Machine Co.
Lancaster Iron Works, Inc.

Mixers (Concrete, Paving, Road Paving, Plaster, Asphalt, Truck, Mortar, Bituminous)
Lancaster Iron Works, Inc.

Mixers (Laboratory)
Lancaster Iron Works, Inc.

Mold Sanders
Lancaster Iron Works, Inc.

Muffles (Furnace) (Laboratory)
Carborundum Co. (*Carbofrax*)
Electro Refractories & Alloys Corp.
Frazier-Simplex, Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Norton Co.

Mullers (Batch)
Clearfield Machine Co.
Lancaster Iron Works, Inc.

Muriatic Acid
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.

Needle Antimony
Ceramic Color & Chemical Mfg. Co.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Nepheline Syenite
Great Lakes Foundry Sand Co.

Nickel Salts
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Nitrates (Cobalt, Sodium)
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Nitre
Ceramic Color & Chemical Mfg. Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.

Norbide (Norton Boron Carbide)
Norton Co.

Olivine
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.

Opacifiers
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Metal & Thermit Corp.
Pemco Corp.
Pennsylvania Salt Mfg. Co.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Overglaze Colors
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.

Oxides
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Metal & Thermit Corp.
Pemco Corp.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Palladium Decorations
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.

Pans—Wet and Dry
Clearfield Machine Co.

Pins
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Ingram-Richardson Mfg. Co. of Indiana, Inc.
Potters Supply Co.

Placing Sand
Great Lakes Foundry Sand Co.
Pennsylvania Pulverizing Co.
United Clay Mining Co.

Platinum Decorations
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.

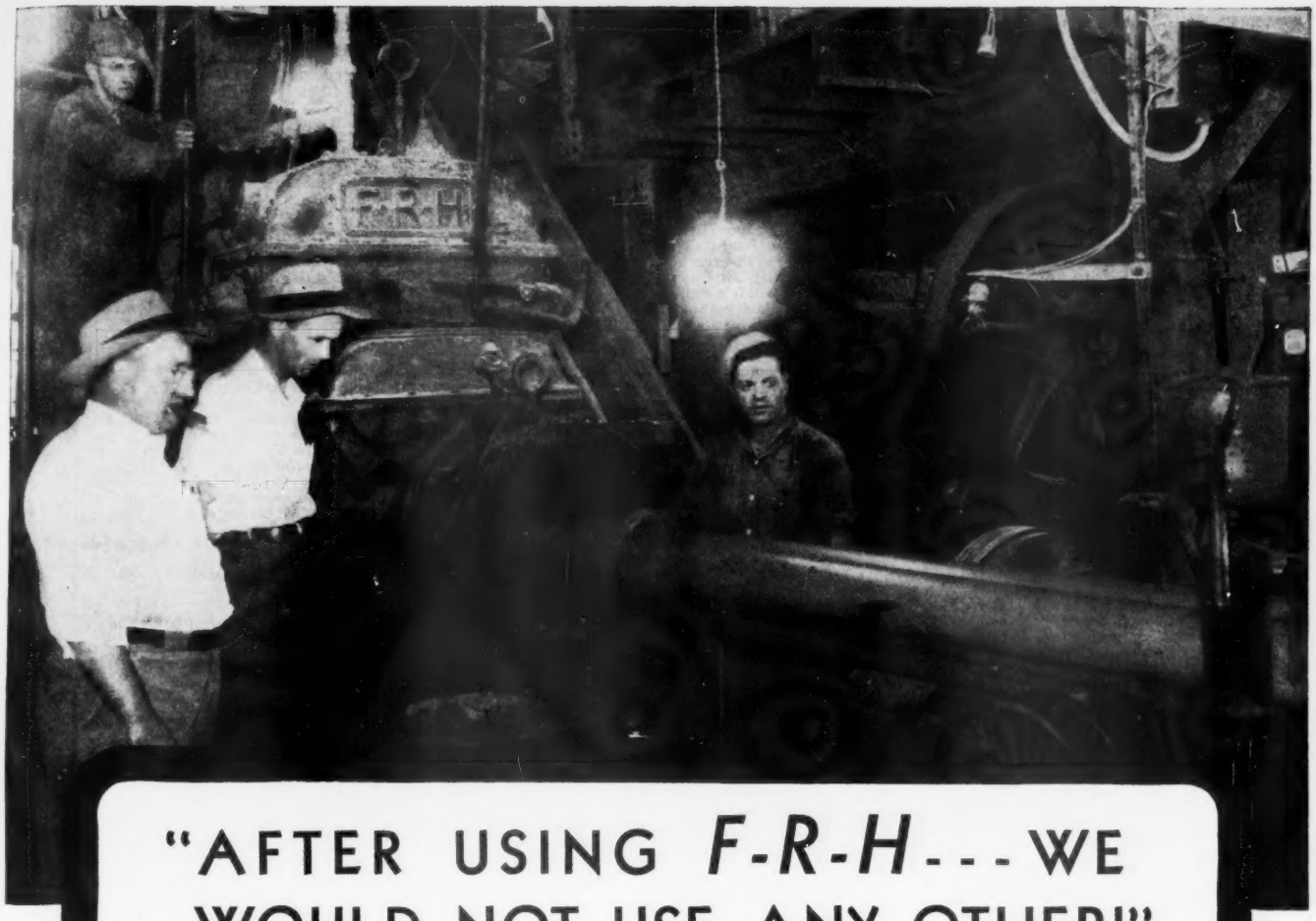
Polariscopes
Bausch & Lomb Optical Co.
Frazier-Simplex, Inc.

Porcelain Enameling Service (Practical)
American Rolling Mill Co.
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Ferro Enamel Corp.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Pemco Corp.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Porcelain Enamels
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Ferro Enamel Corp.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Pemco Corp.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.

Potash (Carbonate)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.

Producer Glass Plants
Frazier-Simplex, Inc.



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Corhart Refractories Co.
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Taylor, Charles, Sons Co.
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Drakenfeld, B. F., & Co.
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Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Orefraction, Inc.
The Vitro Mfg. Co.
Saggers
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.
Potters Supply Co.
Salt Cake
American Potash & Chemical Corp.
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Harshaw Chemical Co.
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Lancaster Iron Works, Inc.
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Selenite of Sodium
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.
Selenium
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.
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American Rolling Mill Co.
Shovels (Power)
Clark Tructractor
Silica (Fused)
Electro Refractories & Alloys Corp.
Foote Mineral Co.
The Hommel, O., Co., Inc.
Silicate of Soda
Ceramic Color & Chemical Mfg. Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Silicon Carbide
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.
Silicon Carbide Firesand
Carborundum Co.
Sillimanite Refractories
Electro Refractories & Alloys Corp.
Taylor, Charles, Sons Co.
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Norton Co.
Slab Pushers—Hydraulic
Spencer Lens Co.
Soda Ash
American Potash & Chemical Corp.
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
The Vitro Mfg. Co.
Sodium Antimonate
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.
Sodium Fluoride
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.
Sodium Metasilicate
Harshaw Chemical Co.
Sodium Nitrite
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Sodium Silica Fluoride
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Sodium Uranate
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Soot Blowers
Frazier-Simplex, Inc.
Special Machines
Frazier-Simplex, Inc.
Spar
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Eureka Flint & Spar Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Maxson, Elwyn L.
The Vitro Mfg. Co.
Spray Booths
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
The Hommel, O., Co., Inc.
Spraying Equipment
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
The Hommel, O., Co., Inc.
Spurs
Potters Supply Co.
Stacks
Lancaster Iron Works, Inc.
Steel Plate Construction
Lancaster Iron Works, Inc.
Stilts
Chicago Vitreous Enamel Product Co.
The Hommel, O., Co., Inc.
Industrial Ceramic Products, Inc.
Potters Supply Co.
Sulfur
Ceramic Color & Chemical Mfg. Co.
Stauffer Chemical Co.
Sulfuric Acid
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Pennsylvania Salt Mfg. Co.
Stauffer Chemical Co.
Talc
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
International Pulp Company
Tanks
Frazier-Simplex, Inc.
Tank Blocks
Corhart Refractories Co.
Tanks (Pickle)
The Hommel, O., Co., Inc.
Tanks for Raw Material Steel or Concrete
Lancaster Iron Works, Inc.
Tile (Floor)
Norton Co.
Tile (Muffle)
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.
Tile (Refractory)
Carborundum Co., (*Carbofrax*)
Electro Refractories & Alloys Corp.
Green, A. P., Fire Brick Co.
Norton Co.
Taylor, Charles, Sons Co.
Tile (Wall)
Green, A. P., Fire Brick Co.
Tin Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
The Vitro Mfg. Co.
Titanium
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.
Titanium Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Foote Mineral Co.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.
Tractors (Light and Heavy Duty Industrial)
Clark Tructractor
Trailers (Wood snd Steel Deck)
Clark Tructractor
Trisodium Phosphate
Ceramic Color & Chemical Mfg. Co.
Harshaw Chemical Co.
Trucks
Lancaster Iron Works, Inc.
Trucks (Dump)
Clark Tructractor
Trucks (Lift and Fork)
Clark Tructractor
Tubes (Insulating)
Carborundum Co.
McDanel Refractory Porcelain Co.
Norton Co.
Tubes (Pyrometer)
Carborundum Co.
Electro Refractories & Alloys Corp.
Leeds & Northrup Co.
McDanel Refractory Porcelain Co.
Montgomery Porcelain Products Co.
Norton Co.
Taylor, Charles, Sons Co.
Uranium Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Harshaw Chemical Co.
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Uranium Oxide (Yellow-Orange-Black)
Ceramic Color & Chemical Mfg. Co.
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The Hommel, O., Co., Inc.
The Vitro Mfg. Co.
Water Softening Plants
Frazier-Simplex, Inc.
Wet Enamel
Ceramic Color & Chemical Mfg. Co.
The Hommel, O., Co., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Pemco Corp.
Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.
Whiting
Ceramic Color & Chemical Mfg. Co.
Drakenfeld, B. F., & Co.
Du Pont de Nemours, E. I., & Co., Inc. Electrochemicals Dept.
Hammill & Gillespie, Inc.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.
Winding Drums
Lancaster Iron Works, Inc.
Zinc Oxide
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
Harshaw Chemical Co.
The Hommel, O., Co., Inc.
The Vitro Mfg. Co.
Zircon
Ceramic Color & Chemical Mfg. Co.
Foote Mineral Co.
The Hommel, O., Co., Inc.
Zirconia
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., Electrochemicals Dept.
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Harshaw Chemical Co.
The Hommel, O., Co., Inc.
Metal & Thermit Corp.
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Titanium Alloy & Mfg. Co.
The Vitro Mfg. Co.
Zirconium Oxide
Ceramic Color & Chemical Mfg. Co.
Foote Mineral Co.
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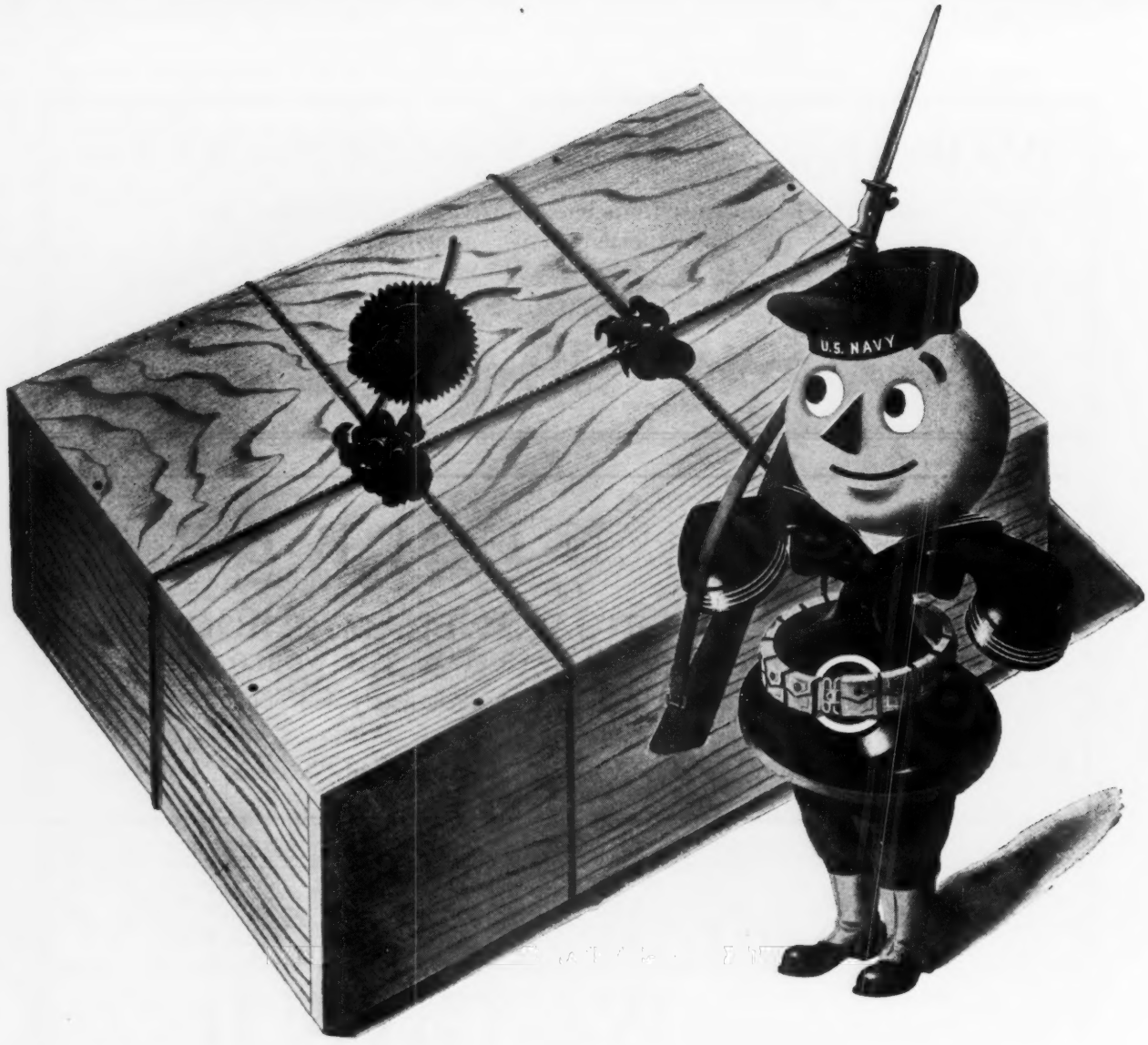

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